Carrier
Transicold

Transport
Air Conditioning

68G5-102 SERIES
MCI G MODEL COACH

Carrier

Operation & Service

T-310 Rev-A

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

BUS
AIR CONDITIONING EQUIPMENT

Model 68G5-102 Series
for
MCI G Model Coach

Carrier Transicold. A member of the United Technologies Corporation family. Stock symbol UTX.
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SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers and start-stop switches are turned off, and power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator and condenser fans. Do not open the condenser fan grille or evaporator access panels before turning power off, and disconnecting and securing the power plug.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

When performing any arc welding on the unit, disconnect all wire harness connectors from the modules in the control box. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static-safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

WARNING

BE SURE TO OBSERVE WARNINGS LISTED IN THE SAFETY SUMMARY IN THE FRONT OF THIS MANUAL BEFORE PERFORMING MAINTENANCE ON THE HVAC SYSTEM

WARNING

READ THE ENTIRE PROCEDURE BEFORE BEGINNING WORK. PARK THE COACH ON A LEVEL SURFACE, WITH PARKING BRAKE APPLIED. TURN MAIN ELECTRICAL DISCONNECT SWITCH TO THE OFF POSITION.

WARNING

DO NOT USE A NITROGEN CYLINDER WITHOUT A PRESSURE REGULATOR

WARNING

DO NOT USE OXYGEN IN OR NEAR A REFRIGERATION SYSTEM AS AN EXPLOSION MAY OCCUR.

CAUTION

Care Must Be Taken To Ensure That The Manifold Common Connection Remains Immersed In Oil At All Times Or Air And Moisture Will Be Drawn Into The System.

WARNING

EXTREME CARE MUST BE TAKEN TO ENSURE THAT ALL THE REFRIGERANT HAS BEEN REMOVED FROM THE COMPRESSOR CRANKCASE OR THE RESULTANT PRESSURE WILL FORCIBLY DISCHARGE COMPRESSOR OIL.

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Service Instructions and Electrical Data for the Model 68G5-102 Coach Air Conditioning and Heating equipment furnished by Carrier Transicold Division for the MCI G-Series Intercity coach. Table 1-1 provides a part (model) number chart.

The Model 68G5-102 equipment (see Figure 1-1) consist of a condenser, a main evaporator and heater, driver evaporator and heater, compressor assembly, main control panel, driver display panel, and temperature sensors.

The 68G5 air conditioning and heating equipment interfaces with electrical cabling, refrigerant piping, engine coolant piping, ductwork and other components furnished by the coach manufacturer to complete the system.

Table 1-1. Part (Model) Number Chart

MODEL NUMBER	CONTROL	CONDENSER KIT	DRIVER DISPLAY	EVAPORATOR MOTOR	CONDENSER MOTOR
68G5-102	Reheat	Aluminum	Standard	Wound Field	Permanent Magnet
68G5-102-1	Reheat	Aluminum	GLI	Wound Field	Permanent Magnet
68G5-102-2	Reheat	Copper	Standard	Wound Field	Permanent Magnet
68G5-102-3	Reheat	Copper	GLI	Wound Field	Permanent Magnet

Table 1-2. Additional Support Manuals

MANUAL/FORM NUMBER	EQUIPMENT COVERED	TYPE OF MANUAL
62–02756	O5G Compressor	Operation and Service
T–200PL	O5G Compressor	Parts List

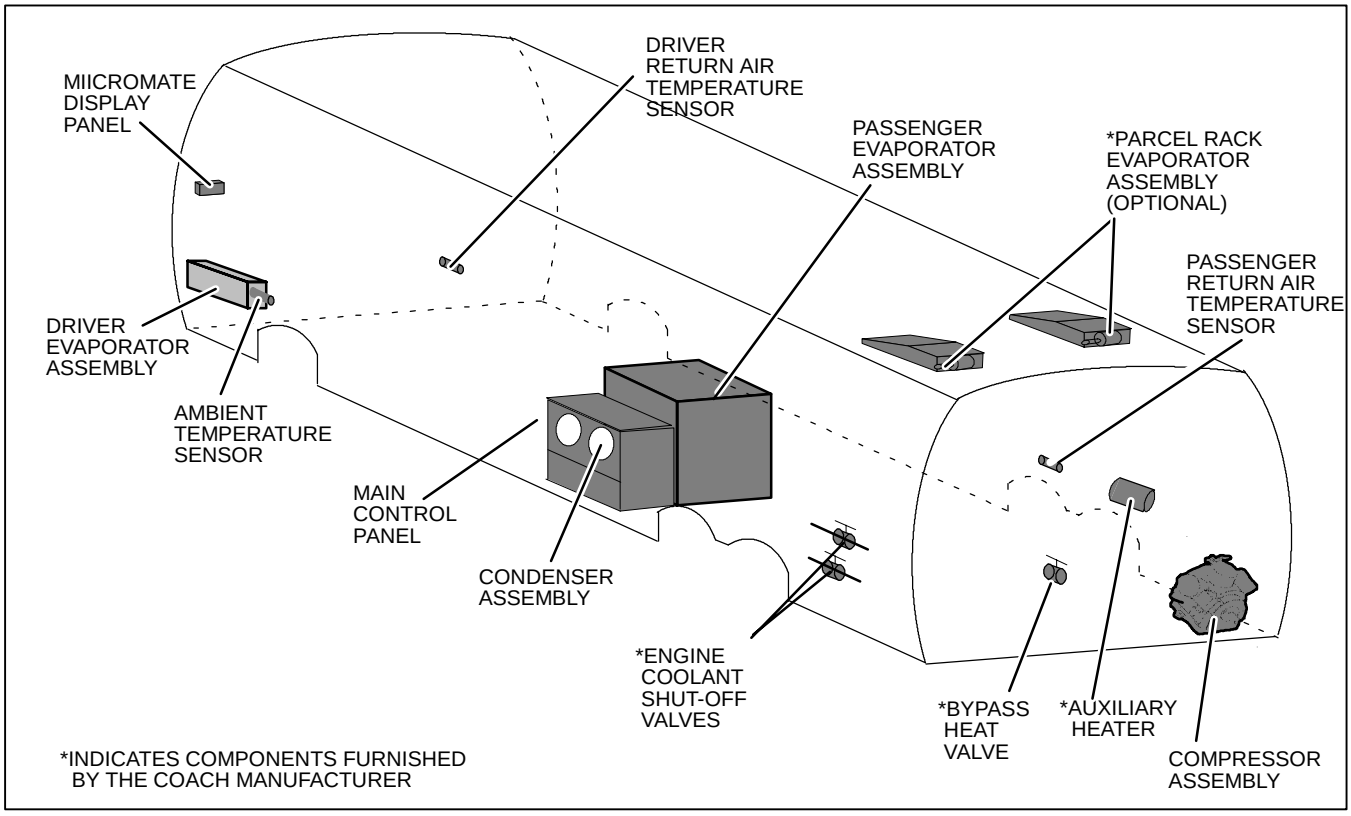


Figure 1-1. Coach Cutaway View

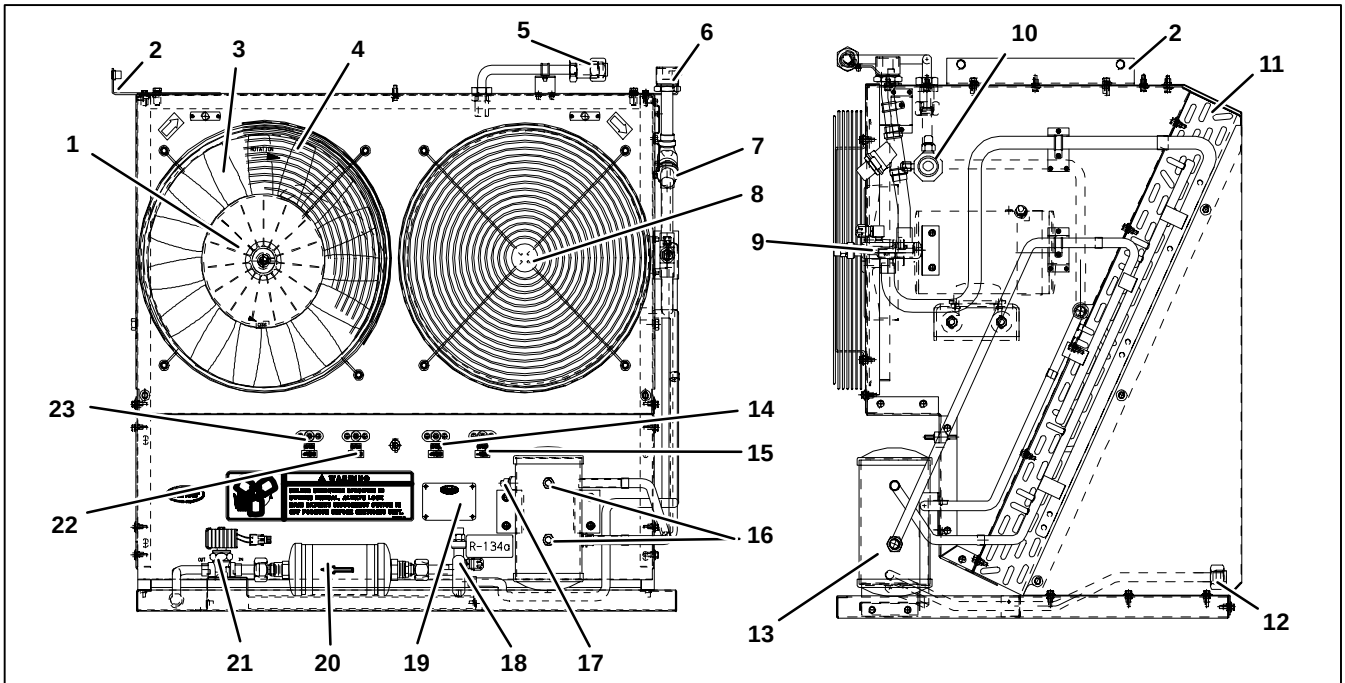
1.2 GENERAL DESCRIPTION

1.2.1 Condenser Assembly

The condenser assembly (See Figure 1-2) includes a condenser coil, fan and motor assemblies, filter-drier, receiver, liquid line solenoid valve, liquid line shut off valve, king valves and a discharge check valve.

The condenser coil provides a heat transfer surface for condensing refrigerant gas at a high temperature and pressure into a liquid at high temperature and pressure. The condenser fans circulate ambient air across the outside of the condenser tubes at a temperature lower than refrigerant circulating inside the tubes; this results in condensing the refrigerant into a liquid. The filter-drier removes moisture and other noncondensibles from the liquid refrigerant before it enters the thermal expansion valves in the evaporator assemblies.

The receiver collects and stores liquid refrigerant. The receiver is fitted with upper and lower liquid level sight glasses to determine refrigerant liquid level. The receiver is also fitted with a fusible plug which protects the system from high refrigerant pressures induced by extreme high temperatures. The liquid line solenoid valve closes when the system is shut down to prevent flooding of coils with liquid refrigerant and to isolate the filter-drier for servicing when the compressor is shut down. The king valves and liquid line shut off valve enable servicing of the condenser assembly.

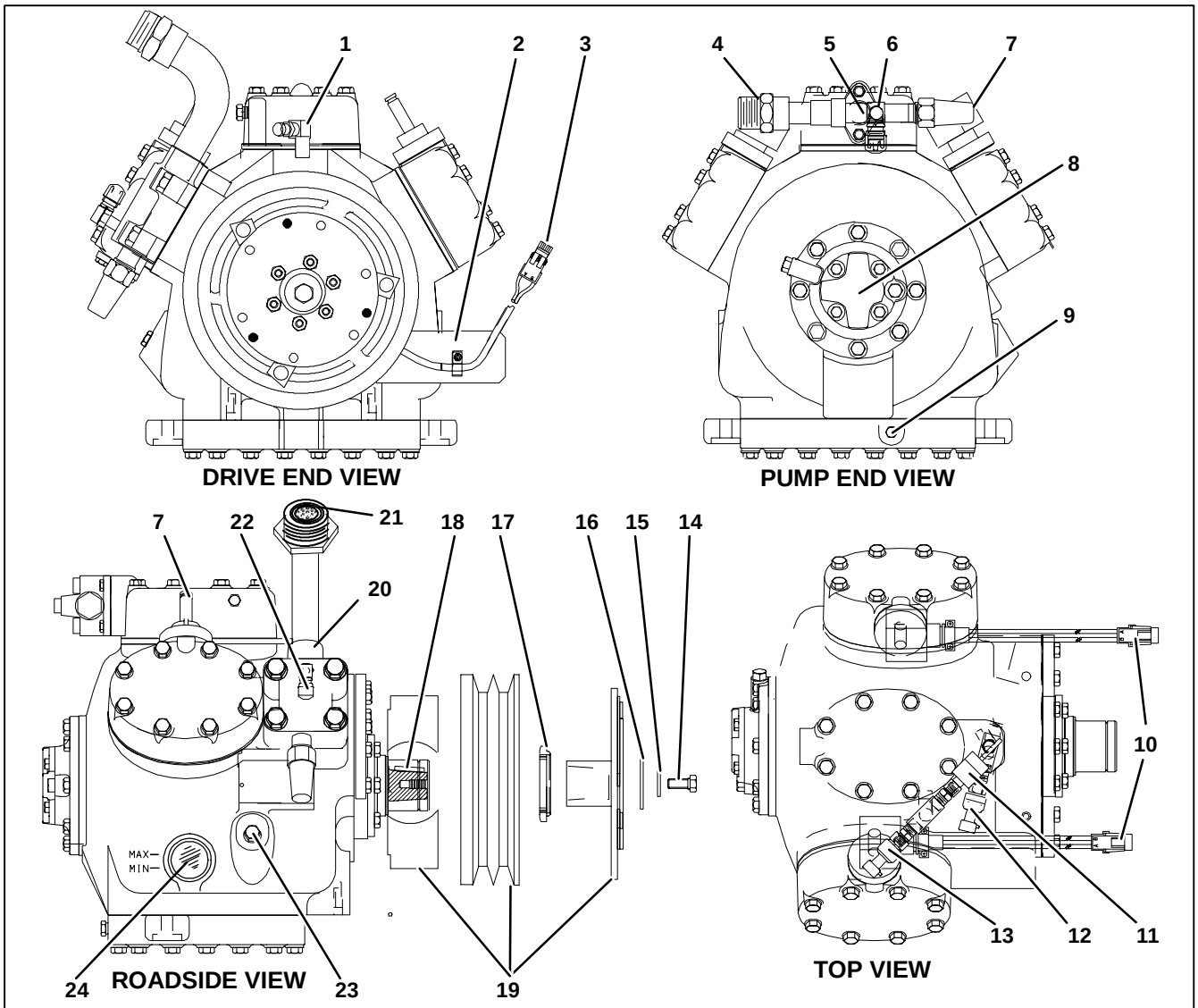


1. Condenser Fan Motor CM1
2. Condenser Support Brace
3. Fan Blade
4. Fan Guard
5. Refrigerant Outlet Fitting (Parcel Rack)
6. Refrigerant Inlet Fitting with O–Ring
7. Discharge Check Valve
8. Condenser Fan Motor CM2
9. Discharge Line Shutoff Valve
10. Liquid Line Shut-off Valve (Parcel Rack)
11. Condenser Coil Assembly
12. Refrigerant Outlet Fitting (Main-Driver)
13. Receiver
14. CFR2 (+) Junction Block
15. CFR2 (–) Junction Block
16. Receiver Sightglass
17. Fusible Plug
18. Liquid Line Shutoff (King) Valve
19. Model/Serial No. Nameplate
20. Filter-Drier
21. Liquid Line Solenoid Valve (Main)
22. CFR1 (–) Junction Block
23. CFR1 (+) Junction Block

Figure 1-2. Condenser Assembly

1.2.2 Compressor Assembly

The compressor assembly (See Figure 1-3.) includes the refrigerant compressor, clutch assembly, suction and discharge service valves, high pressure switch, suction and discharge pressure transducers, suction and discharge servicing (charging) ports and electric solenoid unloaders.



1. Suction Pressure Port
2. Bracket, Belt Guard
3. Weatherpack Clutch Coil Connector
4. Discharge Valve Connection, Size 20 ORS
5. Discharge Service Valve
6. Discharge Valve Charging Port
7. Electric Solenoid Unloader
8. Compressor Oil Pump
9. Oil Drain Plug
10. Electric Solenoid Unloader Connectors
11. High Pressure Switch
12. Suction Pressure Transducer
13. Discharge Pressure Transducer
14. Capscrew
15. Lockwasher
16. Special Washer
17. Lock Nut
18. Key
19. Clutch Assembly
20. Suction Service Valve
21. Suction Valve Connection, Size 24 ORS
22. Suction Valve Charging Port
23. Oil Fill Plug
24. Oil Level Sightglass

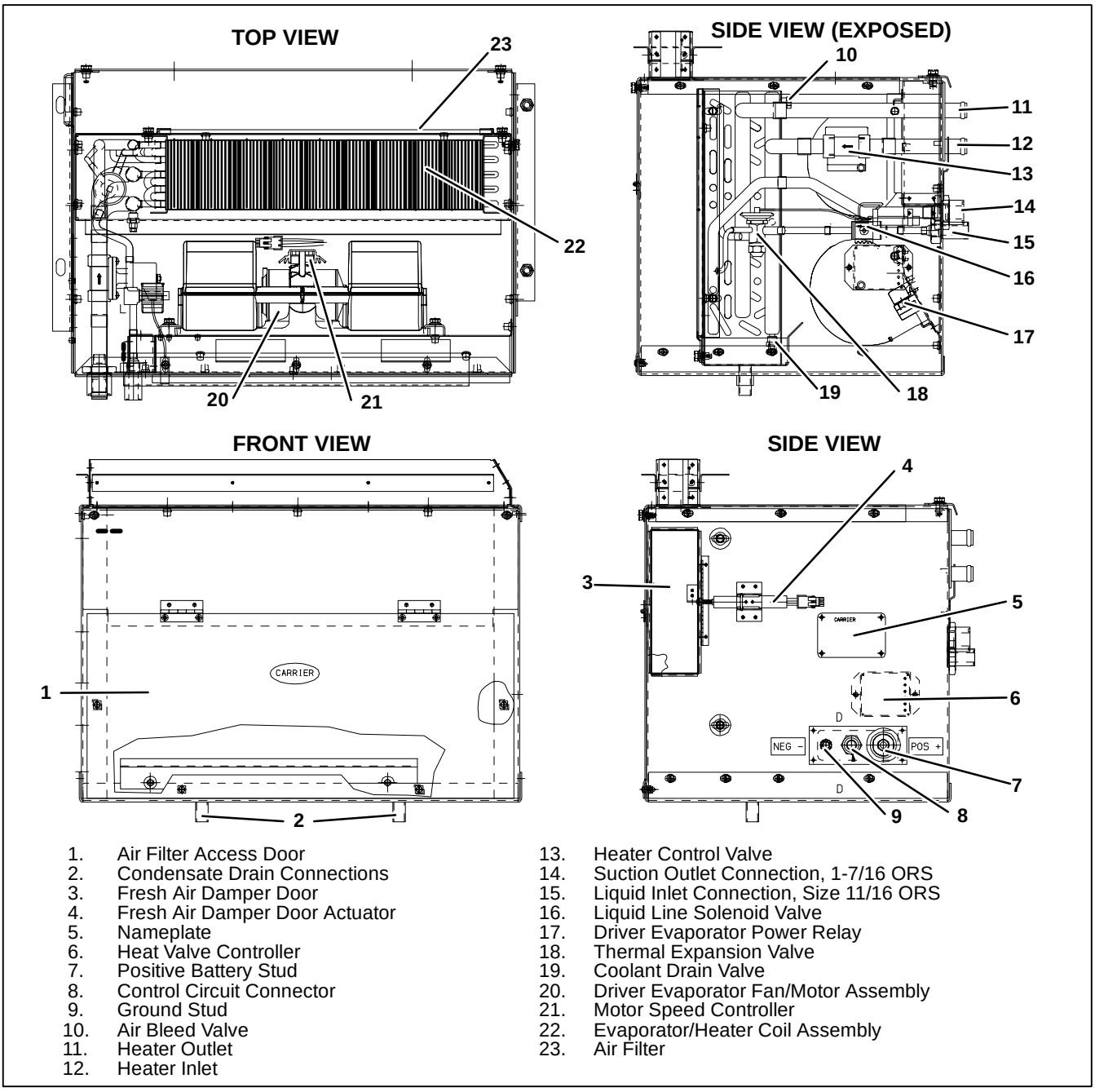
Figure 1-3. Compressor Assembly

The compressor raises the pressure and temperature of the refrigerant gas and forces it into the condenser tubes. The clutch assembly provides a means of belt driving the compressor by the coach engine. The suction and discharge service valves enable servicing of the compressor. Suction and discharge access (charging) ports mounted on the service valves enable connection of charging hoses for servicing of the compressor, as well as other parts of the refrigerant circuit. Transducers convert refrigerant pressures into electrical signal inputs which are sent to the main controller. The high pressure switch (HPS) is a normally closed switch, its contacts open on a pressure rise to shut down the system when abnormally high refrigerant pressures occur. The electric unloaders provide a means of controlling compressor capacity, which enables control of temperature inside the coach. For more detailed information on the O5G compressor, refer to the Operation and Service Manual number 62-02756.

1.2.3 Evaporator Assemblies

The evaporator assemblies include the driver zone evaporator assembly (See Figure 1-4), the passenger zone evaporator assembly (See Figure 1-5), and two parcel rack evaporator assemblies (optional equipment supplied by the coach manufacturer).

The evaporator coils provide a heat transfer surface for transferring heat from air circulating over the outside surface of the coil to refrigerant circulating inside the tubes; thus providing cooling for the passenger and driver zones when required. The thermal expansion valves meter the flow of refrigerant entering the evaporator coils. The heating coils provide a heat transfer surface for transferring heat from engine coolant circulating inside the tubes to air circulating over the outside surface of the tubes, thus providing heating for the passenger and driver zones when required. The evaporator heat valve (EHV) controls the flow of engine coolant supplied to the heating coils. The fans circulate the air over the coils. The air filters filter dirt particles from the air before the air passes over the coils. The condensate drain connections provide a means for disposing of condensate collected on the evaporator coils during cooling operation.



1. Air Filter Access Door
2. Condensate Drain Connections
3. Fresh Air Damper Door
4. Fresh Air Damper Door Actuator
5. Nameplate
6. Heat Valve Controller
7. Positive Battery Stud
8. Control Circuit Connector
9. Ground Stud
10. Air Bleed Valve
11. Heater Outlet
12. Heater Inlet
13. Heater Control Valve
14. Suction Outlet Connection, 1-7/16 ORS
15. Liquid Inlet Connection, Size 11/16 ORS
16. Liquid Line Solenoid Valve
17. Driver Evaporator Power Relay
18. Thermal Expansion Valve
19. Coolant Drain Valve
20. Driver Evaporator Fan/Motor Assembly
21. Motor Speed Controller
22. Evaporator/Heater Coil Assembly
23. Air Filter

Figure 1-4. Driver Evaporator Assembly

The driver zone evaporator assembly includes an evaporator/heater coil assembly, a liquid line solenoid valve (LLSV), a thermal expansion valve (TXV), an evaporator heat valve (EHV), a heat valve controller,

two fan/motor assemblies with motor speed controllers, an air filter, a fresh air damper, and two condensate drain connections. The evaporator motors speeds are variable and controlled manually through a rheostat. The evaporator heat valve (EHV) is also controlled with a rheostat. The liquid line solenoid valve (LLSV) and the fresh air damper damper door are activated through the main controller.

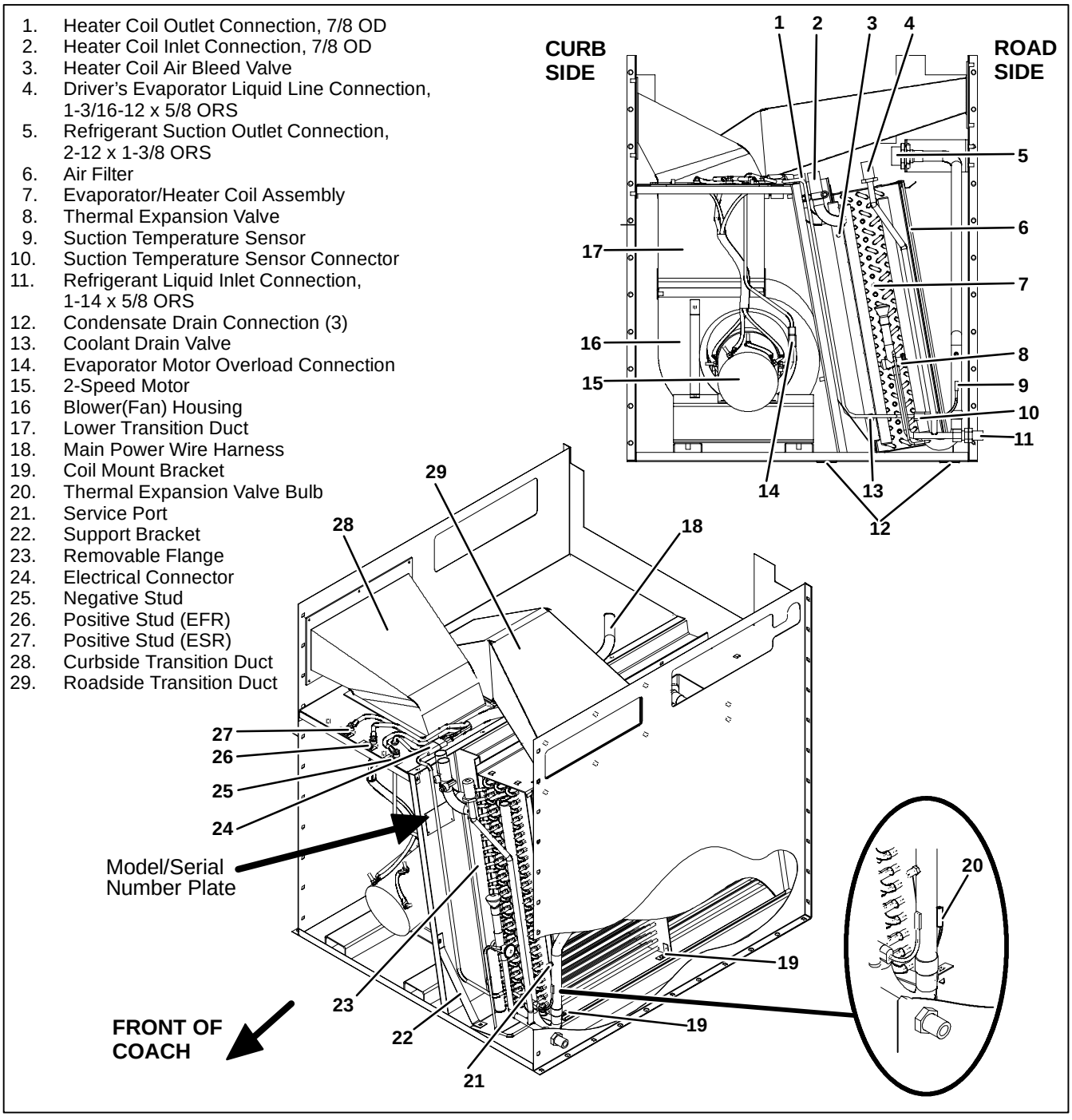

1. Heater Coil Outlet Connection, 7/8 OD
2. Heater Coil Inlet Connection, 7/8 OD
3. Heater Coil Air Bleed Valve
4. Driver's Evaporator Liquid Line Connection, 1-3/16-12 x 5/8 ORS
5. Refrigerant Suction Outlet Connection, 2-12 x 1-3/8 ORS
6. Air Filter
7. Evaporator/Heater Coil Assembly
8. Thermal Expansion Valve
9. Suction Temperature Sensor
10. Suction Temperature Sensor Connector
11. Refrigerant Liquid Inlet Connection, 1-14 x 5/8 ORS
12. Condensate Drain Connection (3)
13. Coolant Drain Valve
14. Evaporator Motor Overload Connection
15. 2-Speed Motor
16 Blower(Fan) Housing
17. Lower Transition Duct
18. Main Power Wire Harness
19. Coil Mount Bracket
20. Thermal Expansion Valve Bulb
21. Service Port
22. Support Bracket
23. Removable Flange
24. Electrical Connector
25. Negative Stud
26. Positive Stud (EFR)
27. Positive Stud (ESR)
28. Curbside Transition Duct
29. Roadside Transition Duct
CURB SIDE
ROAD SIDE
Model/Serial Number Plate
FRONT OF COACH

Figure 1-5. Passenger Evaporator Assembly

The passenger evaporator assembly includes an evaporator/heater coil assembly, a thermal expansion valve (TXV), a fan and fan motor assembly, an air filter, and three condensate drain connections. The fan motor is a two-speed design with low and high speeds. Evaporator fan relays (EFRL and EFRH) change passenger zone evaporator fan speed upon receipt of a signal from the main controller. The evaporator heat valve (EHV) for the passenger evaporator is supplied by the coach builder, installed in the piping outside the evaporator assembly, and is controlled by the main controller.

1.3 System Operating Controls And Components

There are five controls on the driver's station which affect the operation of the Carrier supplied equipment covered by this manual. These controls include two rocker switches, two slide switches, and the Micromate Control Panel. (Figure 1-6)

The first rocker switch (1 Figure 1-6) is the drivers On/Off/Defrost switch which controls the power to the control circuit for the entire system. The first slide switch (2) is labeled the Defrost Switch. This switch controls the driver evaporator blower motor speed. The second slide switch (3) is labeled the Heat Switch. This switch controls the driver evaporator coolant valve. The second rocker switch (4) is labeled the Parcel Rack. This switch will activate the parcel rack evaporators if the passenger evaporator is in operation.

The fifth control is the Micromate Control Panel (Figure 1-7 or Figure 1-8) which operates the Carrier Transicold Micromax microprocessor controller, logic board (Figure 1-10), relay board (Figure 1-9), circuit breakers and relays (Figure 1-11). The logic board regulates the operational cycles of the system by energizing or de–energizing components in response to deviations in interior temperature. Modes of operation include Auto, Cool, Heat and Vent.

The Micromate Control Panel (supplied in one of two configurations) is installed in the upper left hand switch panel. One configuration (Figure 1-7) will allow the driver to turn the system on and off, access outside and interior return air temperatures, and adjust interior temperature setpoint. With this configuration, system diagnostics will need to be performed with the Micromate Diagnostic Service Tool (P/N 76-62124–01). The other configuration (Figure 1-8) will perform the same functions and also allow the driver to control all the system functions manually. In addition this configuration will allow the service technician to view system parameters and alarms.

With the Micromate in the AUTO mode, the logic board will cycle the system between the operating modes as required to maintain desired set point temperature.

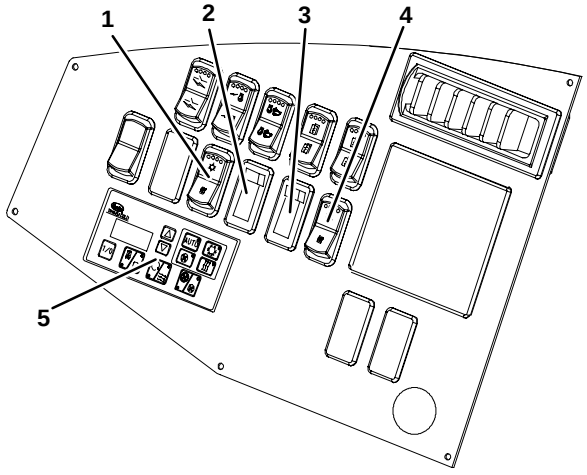
In the VENT mode the evaporator fans are operated to circulate air in the bus interior.

In the HEAT mode the heat valve(EHV), the OEM supplied boost pump and auxiliary heater are energized. The evaporator fans operate to circulate air over the evaporator coil in the same manner as the vent mode.

In the COOL mode the compressor is energized while the evaporator and condenser fans are operated to provide refrigeration as required. The compressor is fitted with cylinder unloaders to match compressor capacity to the bus requirements. Once interior temperature reaches the desired set point, the system may operate in either the clutch cycle or reheat mode(set at the factory, choosen as part of the purchase agreement). A controller programmed for reheat will maintain compressor operation and open the heat valve(EHV) to allow reheating of the return air. In the reheat mode interior temperature is maintained at the desired set point while additional dehumidification takes place. A controller programmed for clutch cycle will de–energize the compressor clutch and allow the system to operate in the vent mode until further cooling is required.

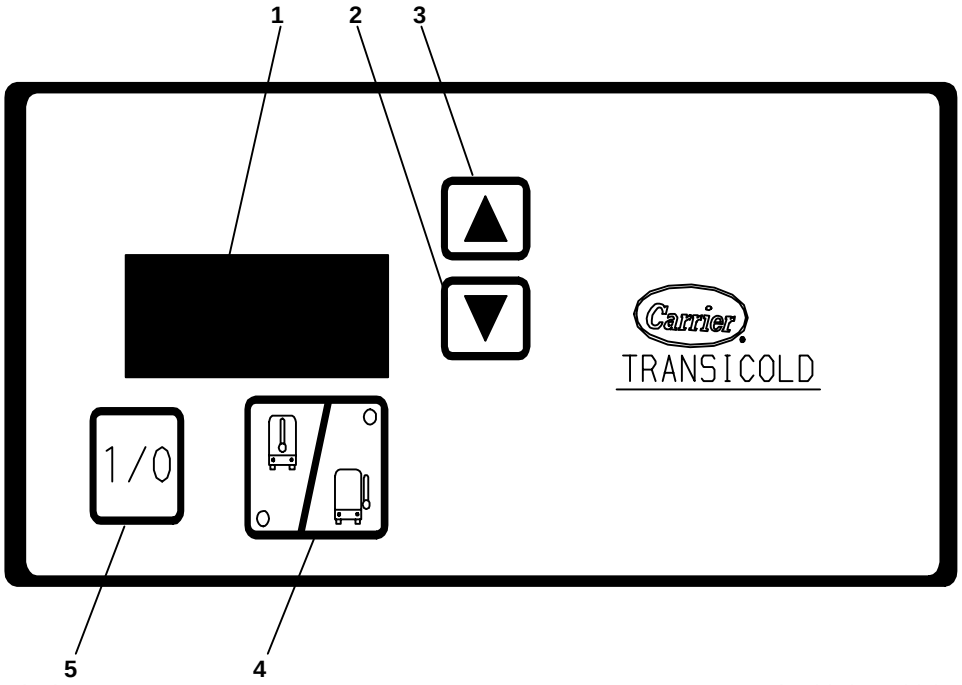
1.3.1 Other Carrier Supplied Items

Other Carrier supplied items include driver and passenger interior return air temperature sensors, and an ambient temperature sensor. The temperature sensors provide input to the controller on temperature conditions in the applicable zone.



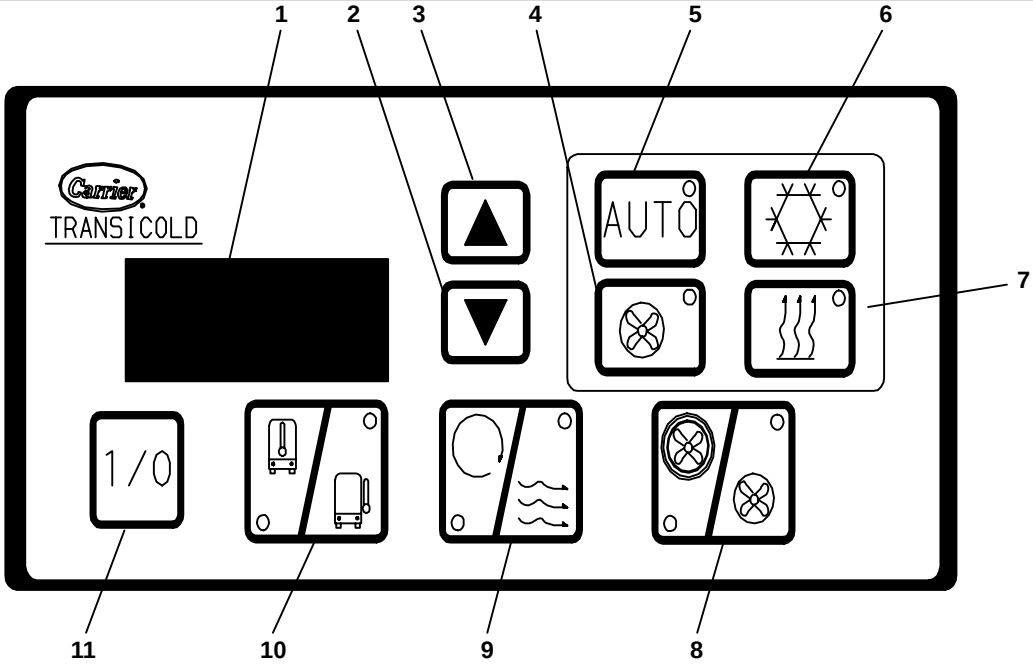
1. System On/Off/Defrost
2. Defrost(Driver's Evap. Blower)
3. Heat(Driver's Evap. Coolant Valve)
4. Parcel Rack On/Off
5. Micromate Control Panel

Figure 1-6. System Operating Controls (upper left hand switch panel)



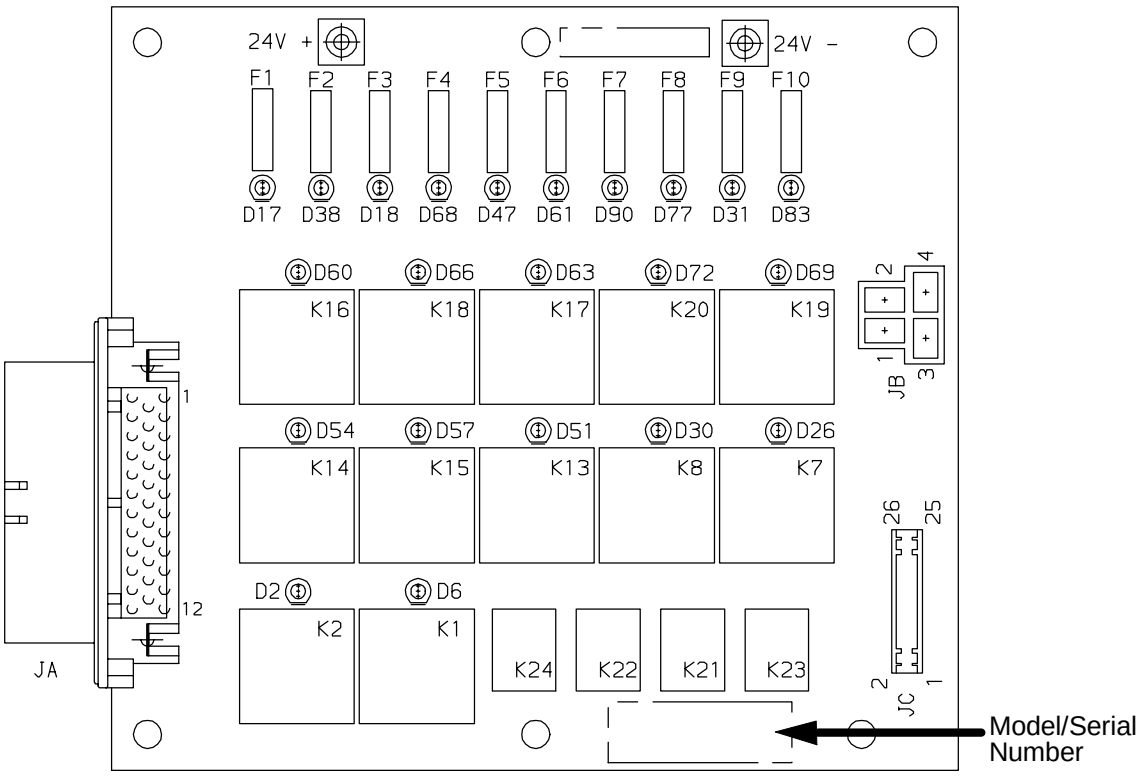
1. Display
2. DOWN Button - decrease selection
3. UP Button - increase selection
4. TEMPERATURE (Inside/Outside) Button
5. ON/OFF Button

Figure 1-7. Micromate Control Panel (GLI)



1. Display
2. DOWN Button - decrease selection
3. UP Button - increase selection
4. Vent (Only) Button
5. AUTO Button (Automatic Control)
6. COOLING (Only) Button
7. HEAT (Only) Button
8. FAN SPEED Button
9. FRESH AIR Button
10. TEMPERATURE (Inside/Outside) Button
11. ON/OFF Button

Figure 1-8. Micromate Control Panel (Standard)



a. Relays

- K1 Energizes evaporator fans
- K2 Energizes evaporator fans in low speed (not energized in low speed).
- K 7 Energizes condenser fans
- K 8 Energizes condenser in high speed (not energized in low speed).
- K13 Energizes the A/C clutch and liquid line solenoid valve.
- K14 Energizes unloader 1.
- K15 Energizes unloader 2.
- K16 Energizes fresh air damper.
- K17 Energizes heat valve (EHV).
- K18 Energizes the fault light output.
- K19 Energizes the boost pump and heat valve.
- K20 Energizes drivers liquid solenoid valve.
- K21 Energizes evaporator fans in high speed.
- K22 Energizes evaporator fans in low speed.
- K23 Energizes condenser fans in high speed.
- K24 Energizes condenser fans in low speed.

b. Connectors

- JA Coach interface
- JB Boost pump.
- JC Logic board connector.

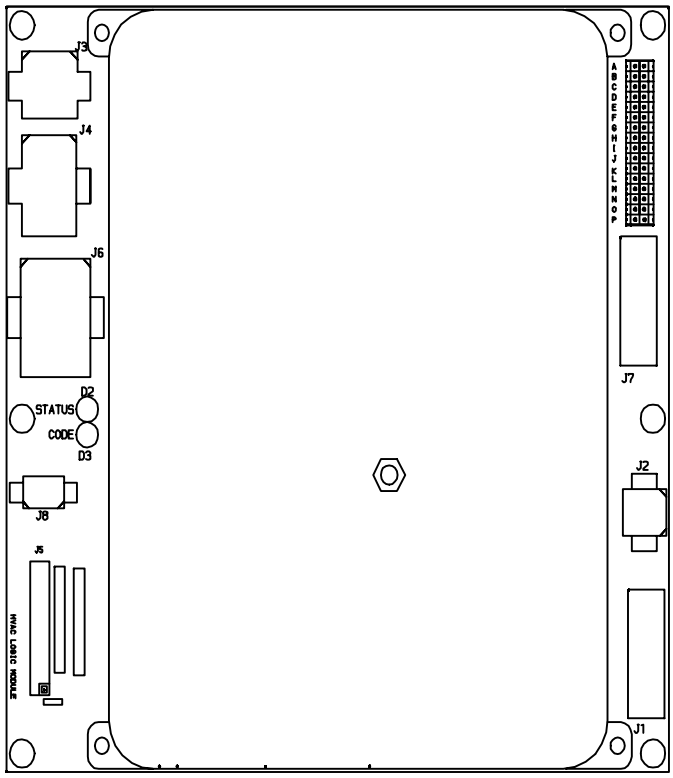
c. Fuses

- F1-F6 5 Amp
- F7 7.5 Amp
- F8-F9 5 Amp
- F10 15 Amp

d. LEDS

- D 2 Relay K2 output active (evaporator fan high speed relay energized)
- D 6 Relay K1 output active (evaporator fan relay energized)
- D17 F1 fuse open (fresh air damper).
- D18 F3 fuse open (evap. fan).
- D26 Relay K3 output active (condenser fan relay energized)
- D30 Relay K8 output active (condenser fan high speed relay energized)
- D31 F9 fuse open (condenser fans).
- D38 F2 fuse open (unloader #1).
- D47 F5 fuse open (unloader #2).
- D51 A/C clutch and liquid line solenoid valve output active.
- D54 Unloader 1 output active.
- D57 Unloader 2 output active.
- D60 Fresh air output active.
- D61 F6 fuse open (heat valve).
- D63 Heat valve output active.
- D66 Fault output active.
- D68 F4 fuse open (fault light).
- D69 circulation pump output active.
- D72 Driver LSV active.
- D77 F8 fuse open (driver LLSV).
- D83 F10 fuse open (circulation pump).
- D90 F7 fuse open (compressor clutch).

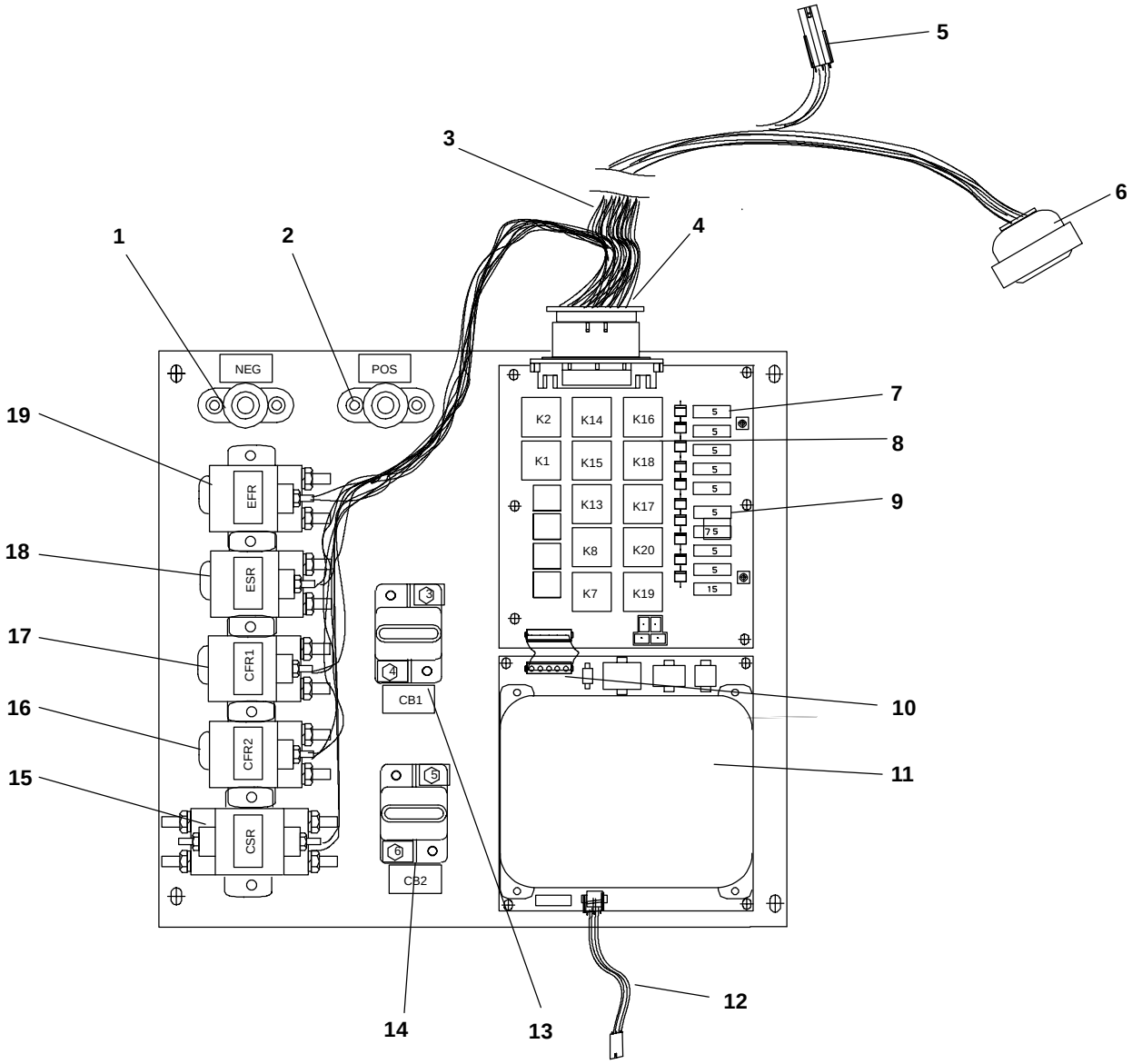
Figure 1-9. Relay Board



J1 Logic board power in
J2 Micromate Display interface.
J3 Manual control inputs.
J4 Interlock Inputs (WTS, etc.)
J5 Relay board interface.
J6 Sensor inputs (Thermistors, etc.).
J7 Diagnostics interface (RS232, DB9)

D2 Blinks once per second in normal operation. On steady to indicate alarms detected.
D3 Off In normal operation, blinks out alarm codes (2 digits each) when alarms detected.
A-P Configuration Jumpers

Figure 1-10. Logic Board



1. Power Stud (Ground)
2. Main Power Stud (Positive)
3. Control Panel Main Harness
4. 35 Pin Connector Plug
5. Evap. Motor Overload Connector
6. Coach Interface Connector (16 Pin)
7. Relay Board
8. Relay
9. Fuse
10. Ribbon Cable (Logic Module to Relay Board)
11. Logic Module
12. Logic Module to Driver Display Harness
13. CB1, Passenger Evap. Motor (110 Amp.)
14. CB2, Condenser Motors (110 Amp.)
15. Condenser Speed Relay (High Speed)
16. Condenser Fan Relay #2
17. Condenser Fan Relay #1
18. Passenger Evaporator High Speed Contactor
19. Passenger Evaporator Relay

Figure 1-11. Electrical Control Panel

1.4 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

e. Refrigerant Charge

R-134a: 27 lb *(12 kg)*

f. Compressor

Model: 05G
No. of Cylinder: 6
Weight (Dry): 145 lb *(66 kg)* including clutch
Oil Charge:
New Compressor: 5.8 pints *(2.7 liters)*
Replacement Compressor: 5 pints *(2.4 liters)*
Oil Level:
Level in sight glass between bottom of glass and middle of glass on compressor crankcase (curbside)
Approved Compressor Oils - R-134a:
Castrol: Icematic SW68C
Mobil: EAL Arctic 68
ICI: Emkarate RL68H

g. Thermostatic Expansion Valve (R-134a):

1. Passenger Evaporator:

Superheat Setting (Nonadjustable): 12 to 18_F *(6.7 to 10.1_C)*
MOP Setting: 65 psig (448 *kPa*)

2. Driver Evaporator:

Superheat Setting (Nonadjustable): 5_F *(-15_C)*
MOP Setting: 65 psig (448 *kPa*)

h. High Pressure Switch (HPS) (R-134a):

Opens at: 350 ±10 psig *(2.7 mPa ± 69 kPa)*
Closes at: 240 ±10 psig *(2.0 mPa ± 69 kPa)*

1.5 ELECTRICAL SPECIFICATIONS - WOUND FIELD MOTORS

a. Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Horsepower:
High Speed: 2.0 *(1.49 kw)*
Low Speed: 0.9 *(0.67 kw*)
Full Load Amps (FLA):
High Speed: 70
Low Speed: 32
Operating Speed:
High Speed: 1600 rpm
Low Speed: 1250 rpm
Voltage: 27 vdc

b. Driver Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA): 11
Operating Speed:
High Speed: 2700 rpm
Low Speed: 1100 rpm
Voltage: 24 vdc

c. Condenser Fan Motor

Bearing Lubrication: Shell Dolium R
Horsepower: 0.8 hp *(1.072 kw)*
Full Load Amps (FLA):
High Speed: 27
Low Speed: 20
Operating Speed:
High Speed: 1800 rpm
Low Speed: 900 rpm
Voltage: 24 vdc

1.6 ELECTRICAL SPECIFICATIONS-MAIN CONTROLLER INPUT SENSORS AND TRANSDUCERS

a. Suction and Discharge Pressure Transducer

Supply Voltage: 4.5 to 5.5 vdc (5 vdc nominal)
Input Range: –6.7 to 450 psig *(–46.2 kPa to 3.1 mPa)*
Output: 1.446 vdc at 100 psig
(See Table 4-2 for calculations.)

b. Temperature Sensors

Input Range: –52.6 to 158_F *(–47 to 70_C)*
Output: NTC 10K ohms at 77_F *(25_C)*
(See Table 4-1 for calculations.)

1.7 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices. Safety devices installed in Carrier Transicold supplied equipment include high pressure switch (HPS), the fusible plug, and circuit breakers (CB1 and CB2). (See Table 1-3.)

In addition, evaporator and condenser fan motors and the main control box are protected independently against high current draw by circuit breakers supplied by the coach manufacturer. The evaporator fan motor is also protected from high temperature with an internal thermal protection switch.

Fuse (F2), internal to the controller, protects the controller 12 vdc supply circuit from excessive current draw. Fuse (F3) protects the controller 24 vdc output circuit from excessive current draw.

a. Thermal Switches

Evaporator Motor Overloads (EMOL)

The evaporator fan motor is equipped with an internal thermal protector switch. When a high temperature condition occurs, the appropriate EMOL switch will open to de-energize the corresponding evaporator fan relay (EFR); this will prevent the evaporator fan motor from operating.

b. Pressure Switches

High Pressure Switch (HPS)

The high pressure switch (HPS) is installed in the compressor center cylinder head and opens on a pressure rise to shut down the system when high pressure conditions occur. The switch is factory set to open at 350 ±10 psig *(2.4 mPa ±69 kPa)* and to close at 240 ±10 psig *(1.7 mPa ±69 kPa)*.

During the A/C mode, HVAC system operation will automatically stop if the HPS switch contacts open due to an unsafe operating condition. Opening HPS contacts de-energizes, through the main controller, the A/C compressor clutch shutting down the system.

c. Fuses and Circuit Breakers

The Relay Board is protected against high current by an OEM supplied 150 amp fuse or circuit breaker. Independent 110 amp circuit breakers protect each motor circuit, while the output circuits are protected by additional 5 to 15 amp fuses. During a high current condition, the OEM breaker may open. When power is removed from a device, a breaker alarm will be generated. In addition the driver's evaporator is protected by an OEM supplied 30 amp. circuit breaker.

d. Ambient Lockout

The ambient temperature sensor, located near the driver evaporator section, measures the inlet air temperature. When the temperature is below the cut out set point the compressor is locked out until the temperature rises above the cut in setting. The set points will be programmed to cut out at 25°F (-3.9°C) and cut in at 35°F (1.7°C). This setting protects the compressor from damage caused by operation at low temperatures.

Table 1-3. Safety Devices (Within Carrier Supplied Equipment)

Unsafe Condition	Safety Device	Device Setting
Excessive current draw by driver evaporator motors	Circuit Breaker Manual Reset	30 amps
High compressor discharge pressure	High Pressure Switch (HPS)	Opens at: 350 ±10 psig *(2.4 mPa ±69 kPa)* Closes at: 240 ±10 psig *(1.7 mPa ±69 kPa)*
High refrigerant pressures induced by extreme high temperature	Fusible Plug	Melts to relieve pressure at 210_F Does not close, replacement necessary once blown
Excessive current draw by the controller 12 vdc supply circuit	Fuse (F2)	Opens at 5 amps
Excessive current draw by the controller 24 vdc output circuit	Fuse (F3)	Opens at 10 amps
Excessive current draw by evaporator motor	Circuit Breaker (CB1) Automatic Reset	110 amps
Excessive current draw by condenser motor	Circuit Breaker (CB2) Automatic Reset	110 amps

1.8 HEATING (ENGINE COOLANT) FLOW CYCLE

Heating circuit components furnished by Carrier Transicold include heater cores for the driver and main evaporator assemblies and the evaporator heat valve (EHV) for the driver evaporator assembly. Components furnished by the coach manufacturer include auxiliary heater(optional) and engine water pumps and hand valves. The main controller automatically controls the EHV valves during heating and reheat cycles to maintain required temperatures inside the coach. Engine coolant (glycol solution) is circulated through the heating circuit by the engine and auxiliary water pumps. When the evaporator heat valve solenoid is de-energized, the valve will open to allow engine coolant to flow through the heater coil. (See Figure 1-12.) The valve is normally open so that if a failure occurs, the system will still be able to supply heat.

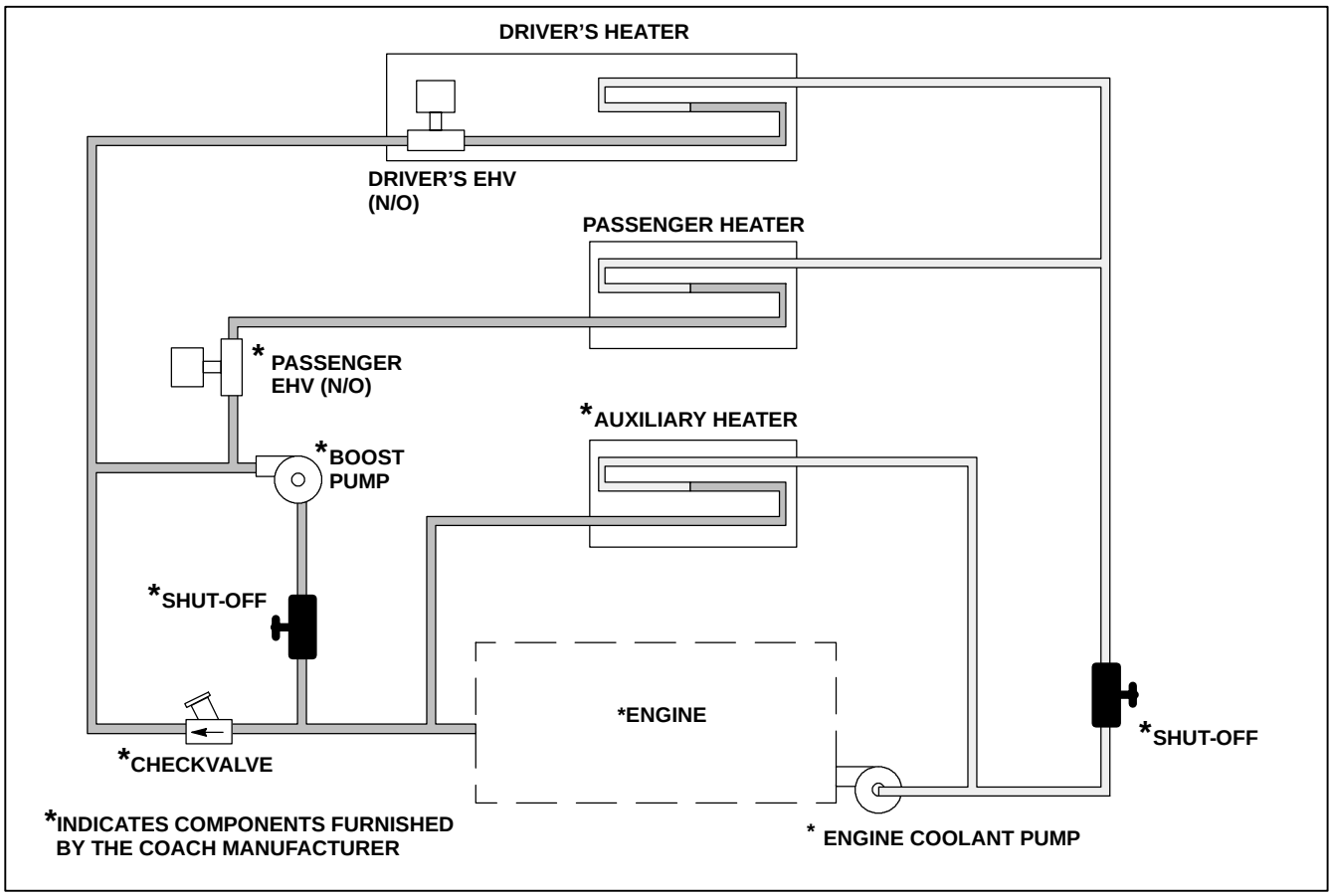


Figure 1-12. Heating System Flow Diagram

1.9 AIR CONDITIONING REFRIGERANT CYCLE

When air conditioning (cooling) is selected by the main controller, the unit operates as a vapor compression system using R-134a as a refrigerant. The main components of the system are the reciprocating compressor, air-cooled condenser coil, subcooler, receiver, filter-drier, thermostatic expansion valves, liquid line solenoid valves and evaporator coils. (See Figure 1-13 .)

The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge line, through the check valve into the condenser tubes. The condenser fan circulates surrounding air (which is at a temperature lower than the refrigerant) over the outside of the condenser tubes. Heat transfer is established from the refrigerant (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air; this removal of heat causes the refrigerant to liquefy, thus liquid refrigerant leaves the condenser and flows to the receiver.

The receiver serves as a liquid refrigerant reservoir so that a constant supply of liquid is available to the evaporators as needed, and acts as an isolated storage space when pumping down the system. The receiver is equipped with sight glasses to observe the refrigerant for correct charge level.

The refrigerant leaves the receiver and then flows through the subcooler, which subcools the refrigerant before it enters the thermal expansion valves; this reduces flash gas in the evaporator. From the subcooler, the refrigerant passes through the liquid line service valve, and then through a filter-drier which keeps the refrigerant clean and free of water.

From the filter-drier, the liquid refrigerant then flows through the main liquid solenoid valve to the passenger evaporator thermal expansion valve and through the driver solenoid valve and to the driver thermal expansion valve. The solenoid valves open during cooling to allow refrigerant to flow to the thermal expansion valves. The main liquid solenoid valve and closes during shutdown to isolate the refrigerant in the receiver. The thermal expansion valves reduce the pressure and temperature of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator blower (fan). Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (flowing inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant; therefore the cooler air is circulated to the interior of the coach. Liquid line solenoid valves close during shutdown to prevent refrigerant flow.

The transfer of heat from the air to the low temperature liquid refrigerant in the evaporator causes the liquid to vaporize. This low temperature, low pressure vapor passes through the suction line and returns to the compressor where the cycle repeats.

When ventilation only is selected by the main controller, only the evaporator fans function to circulate air throughout the coach. The refrigerant cycle will remain off.

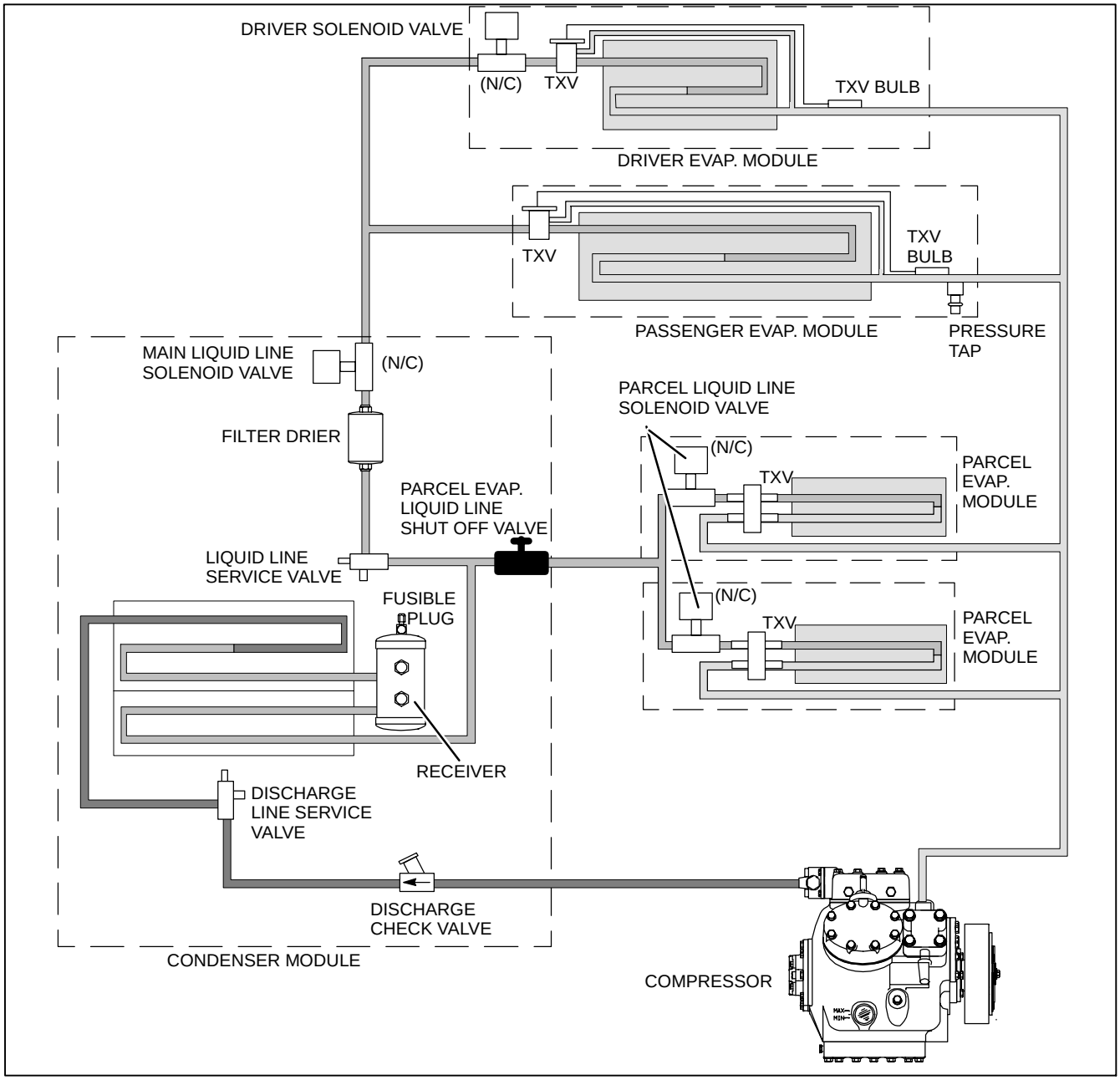


Figure 1-13 Air Conditioning Refrigerant Flow Diagram

SECTION 2

OPERATION

2.1 STARTING, STOPPING AND OPERATING INSTRUCTIONS

2.1.1 Power to Logic Board

Before starting, electrical power must be available from the coach power supply. The system components receive power from two sources:

a. OEM SUPPLIED SWITCHES
An ON/OFF/DEFROST switch is supplied. In the ON position the Micromate Control Panel and the driver's evaporator are fully functional. In the Off position the driver's evaporator is shut off, but the Micromate Control Panel is functional. In the Defrost position, only the driver's evaporator is functional.(Refer to Figure 1-6, item 1)

b. 24 vdc power for the microprocessor electronics is supplied through the coach wiring harness.

c. 24 vdc power thru a 150 amp fuse in the battery compartment supplies power for the clutch, compressor, unloader solenoids, evaporator and condenser assemblies; this power is controlled by the Logic Board.

2.1.2 Starting

a. If the engine is not running, start the engine.

b. OEM SUPPLIED SWITCHES
An ON/OFF/DEFROST switch is supplied, place the switch in the ON position to start the system in the automatic mode. (Refer to Figure 1-6, item 1)

c. MICROMATE CONTROL PANEL (GLI, Figure 1-7)

1 The Micromate Control Panel displays the set point temperature or return air temperature.

2 The Micromate Control Panel will signal the Logic Board to perform start up when the ON/OFF/DEFROST switch is thrown (refer to 2.1.2.b.).

3 To read interior or exterior temperature, press the TEMPERATURE button to illuminate the indicator light . After a short delay, the display will return to the default set point or return air temperature reading.

4 Setpoint may be changed by pressing the UP or DOWN arrow button. The UP button will increase the setpoint temperature and the DOWN button will decrease the setpoint temperature.

d. MICROMATE CONTROL PANEL (Standard, Figure 1-8)
If this control panel is supplied, it is suggested the system be started in the automatic mode.

1 The Micromate Control Panel Display may be programmed to display the set point temperature or return air temperature. To determine which display temperature is programmed, press the TEMPERATURE button so that the OUT SIDE AIR indicator is illuminated. If the controller cycles back to the INSIDE AIR indicator, than the controller is programmed to display return air temperature. If the controller does not automatically cycle back to the return air indicator, than the controller is programmed to display set point temperature.

2 The Micromate Control Panel will signal the Logic Board to perform start up when the ON/OFF/DEFROST switch is thrown (refer to 2.1.2.b.). Ensure the AUTO button indicator is illuminated. If not, press the AUTO button to place the system in the automatic mode. After the pre–trip inspection is completed, the switches may be set in accordance with the desired control modes.

3 If cooling only, heating only or ventilation only is desired, press the corresponding button (refer to Figure 1-6) to illuminate the indicator light and place the system in that mode of operation.

4 If low or high speed evaporator fan speed is desired, press the FAN SPEED button to illuminate the indicator light and bring speed to the desired level.

5 To open or close the fresh air damper, press the FRESH AIR button.

6 To read interior or exterior temperature, press the TEMPERATURE button to illuminate the indicator light and bring the display to the desired temperature reading. After a short delay, the display will return to the default set point or return air temperature reading.

7 Setpoint may be changed by pressing the UP or DOWN arrow button. The UP button will increase the setpoint temperature and the DOWN button will decrease the setpoint temperature.

8 For additional Micromate operating data refer to paragraph 3.3.

2.1.3 Driver's Area / Parcel Racks

The driver's evaporator is manually controlled with four switches located on the driver's control panel. Before starting, power must be available to the main system. For cooling the Micromate must be On. For heating the engine must be running and up to operating temperature.

a. If the engine is not running, start the engine.

b. OEM SUPPLIED SWITCHES
An ON/OFF/DEFROST switch is supplied, place the switch in the ON position if air conditioning of the driver's area is desired. If heating/defrosting of the driver's area is required, and conditioning of the passenger area is not required, place the switch in DEFROST.(Refer to Figure 1-6, item 1)

1 Two sliding switches are provided to control the driver's evaporator. The Defrost switch(Refer to Figure 1-6, item 2) controls evaporator blower speed. The Heat switch(Refer to Figure 1-6, item 3) controls the amount of engine coolant that circulates through the heater core.

2 One rocker switch (Refer to Figure 1-6, item 4)is provided to control the optional parcel evaporators. Activating this switch operates the blowers and liquid line solenoid valves of both parcel evaporators. The parcel evaporators will function only if the main evaporator is functioning.

2.1.4 Self-Test and Diagnostics (Check for Errors and/or Alarms)

Self-test of the main Logic Board electrical circuit is automatically initiated when the system is powered up. If there is an error in the circuit, an alarm will be indicated by flashing LED's on the Logic Board. If a Micromate is connected to the Logic Board, the error code can also be read on the display. If there are no errors in the circuit, system will operate normally and flash the status LED at a one second interval. During normal operation, the Logic Board monitors system operating parameters for out of tolerance conditions. If an out of tolerance condition occurs, *ALARM* will be indicated through the code LED or on the Micromate display. Refer to section 3 for definition of system errors and alarms and general troubleshooting procedures.

2.1.5 Shut Down

Placing the ON/OFF/DEFROST switch in the OFF position will shut down the system operation by removing power to the Logic Board. Pressing the Micromate ON/OFF button will shut off the passenger evaporator.

NOTE

All operations described in this chapter beyond this point must be performed by an HVAC technician who has been trained on Carrier system design. It is recommended that Carrier Service or Engineering is contacted before any control operation beyond chapter 2.1 is attempted. Carrier is not responsible for failures or damage resulting from unauthorized changes.

2.2 PRE-TRIP INSPECTION

After starting system, allow system to stabilize for ten to fifteen minutes and check for the following:

a. Listen for abnormal noises in compressor or fan motors.

b. Check compressor oil level. (Refer to section 4.12.2)

c. Check refrigerant charge. (Refer to section 4.7.1)

d. Ensure that self-test has been successfully performed and that there are no errors or alarms indicated. (Refer to section 2.1.4.)

2.3 MODES OF OPERATION

The system is operated by a Carrier Transicold Micromax microprocessor controller which consists of a logic board (Figure 1-10), relay board (Figure 1-9), and manual operator switches. The logic board regulates operational cycles of the system by energizing or de-energizing Relay Board relays in response to deviations in interior temperature. The basic modes of operation include Cooling, Heat and Vent. Refer to Figure 2-1 and the following paragraphs for a description of each mode.

Figure 2-1 shows the Logic Board actions at various temperature deviations from setpoint. On rising temperature, changes occur when the temperature rises above Logic Board set points. On falling temperature, changes occur when temperatures falls below Logic Board set point. Note that the Logic Board reacts to ambient temperatures as well as deviations from set point, to allow for more precise temperature control. The system will operate in these modes unless pressures override the Logic Board settings.

2.3.1 Temperature Control

Temperature is controlled by maintaining the return air temperature measured at the return air grills. (See Figure 1-1 for approximate locations) The system controller responds(averages) to both return air sensors.

2.3.2 Cooling Mode

Cooling is accomplished by energizing the compressor and condenser fans, opening the liquid line solenoid valve and closing the heating valve. Once interior temperature reaches the desired set point, the system may operate in the clutch cycle or reheat mode. Selection of clutch cycle or reheat is factory programmed in accordance with the coach purchase specification.

A controller programmed for clutch cycle will de-energize the compressor clutch and allow the system to operate in the vent mode until further cooling is required.

A controller programmed for reheat will maintain compressor operation and cycle the heat valve to allow reheating of the return air. In the reheat mode interior temperature is maintained at the desired set point while additional dehumidification takes place.

2.3.3 Heating Mode

In the heat mode the liquid line solenoid is closed and the compressor and condenser fans are shut down. The heat valve is opened to allow a flow of engine coolant through the heat section of the evaporator coil. The evaporator fans speed is varied as required to circulate air over the evaporator coil based on the temperature difference from setpoint.

Operation in the heating mode is controlled by the water temperature switch (WTS). The switch prevents the circulation of cooler air throughout the vehicle until engine coolant temperature reaches 190°F. The WTS is located on the engine block of the vehicle and is provided by the OEM.

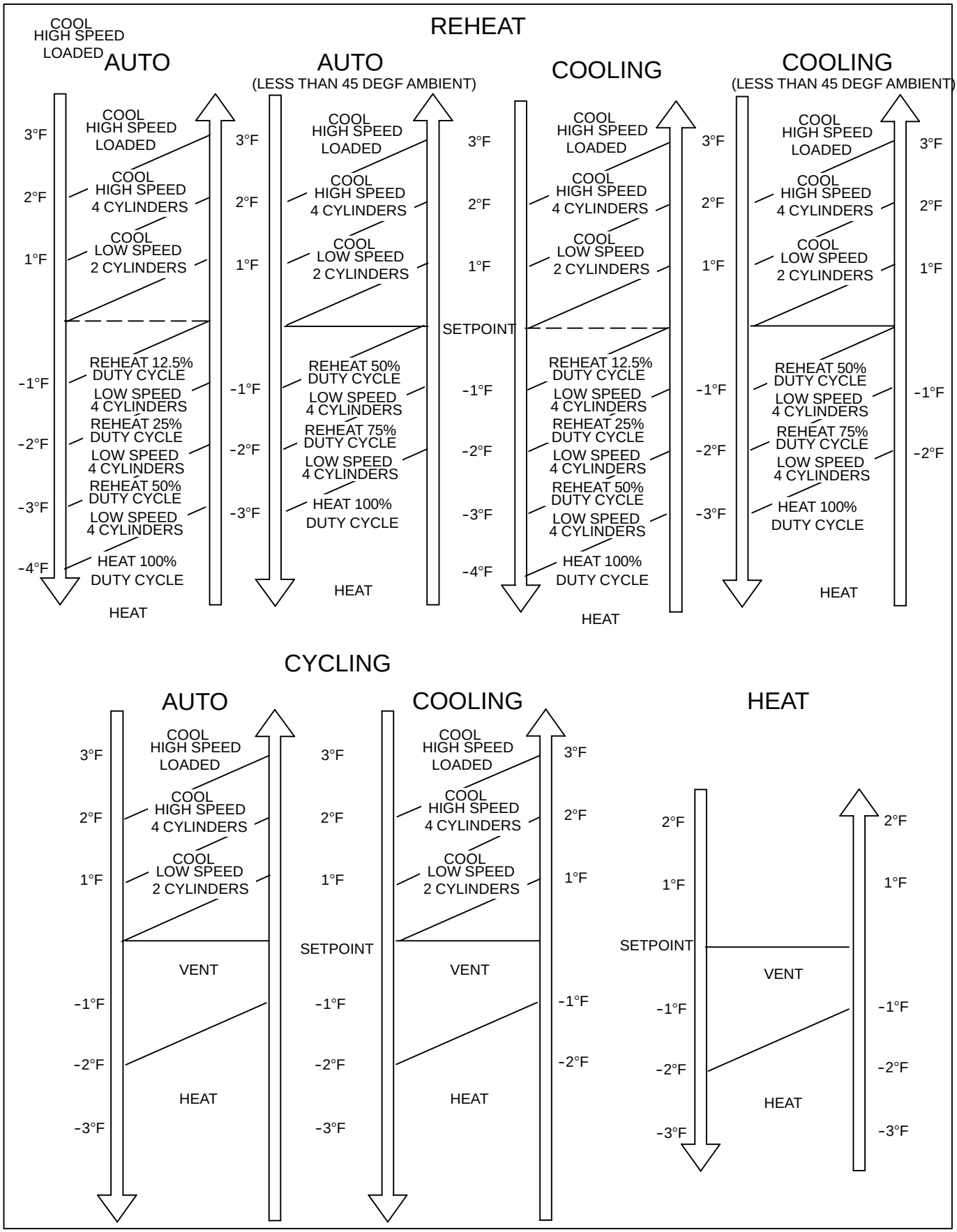


Figure 2-1 Capacity Control Diagram

2.3.4 Boost Pump

When the unit is in the heat mode, the boost pump relay is energized, providing 24 VDC to activate the boost pump(supplied by the coach manufacturer).

2.3.5 Vent Mode

In the vent mode the evaporator fans are operated to circulate air in the coach interior without benefit of either cooling or heating.

2.3.6 Compressor Unloader Control

When operating in cooling, the unloaders are used to reduce system capacity as return air temperature approaches set point. Operation of the unloaders balances system capacity with the load and thereby prevents overshoot from set point.

Relay Board mounted unloader outputs control the capacity of the compressor by energizing or de-energizing unloader solenoid valves. The model 05G compressor has three banks of two cylinders each. Energizing a valve de-activates a bank of cylinders. The outboard cylinder banks of the 05G are equipped with unloader valves (UV1 and UV2), each controlling two cylinders; this allows the 05G to be operated with two, four or six cylinders.

Whenever the compressor is started, the unloaders are energized for a 30 second delay time to reduce starting torque. After the delay, unloaders may be de-energized. Any subsequent changes between energizing and de-energizing the unloaders for temperature control is also staged for a preset delay time. Once an unloader is energized for pressure control, it remains energized for two minutes to prevent short cycling. Only one unloader may change state at a time when staging is required. Operating parameters for temperature control, suction pressure control and discharge pressure control are as follows.

a. Capacity Control

The unloaders are used to control system capacity by controlling compressor capacity.

1 Compressor Unloader UV1 Relay. When return air temperature falls to less than 2°F (1.1°C) above set point unloader UV1 is energized. If temperature rises to greater than 3°F (1.7°C) above set point, UV-1 will be de-energized to place the compressor at 100% capacity.

2 Compressor Unloader UV2 Relay. When return air temperature falls to less than 1°F (0.6°C) above set point unloader UV2 is energized. If temperature rises to greater than 2°F (1.1°C) above set point, UV-2 will be de-energized to place the compressor at 66% capacity.

b. Suction Pressure

The unloaders are used to control suction pressure and thereby prevent coil frosting:

1 Compressor Unloader UV1 Relay. When the suction pressure decreases below 26 psig, unloader UV1 is energized unloading a cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 33 psig.

2 Compressor Unloader UV2 Relay. When suction pressure decreases below 23 psig, unloader UV2 is energized unloading the second compressor cylinder bank; this output will remain energized until the pressure increases to above 30 psig.

c. Discharge Pressure

Discharge pressure is also controlled by the unloaders:

1 Compressor Unloader UV1 Relay. When the discharge pressure increases above 330 psig, unloader UV1 is energized; this output will remain energized until the pressure decreases below 245 psig. Staging is ignored during discharge pressure override.

2 Compressor Unloader UV2 Relay. When the discharge pressure increases above 330 psig, unloader UV2 is energized; this output will remain energized until the pressure decreases below 245 psig. Staging is ignored during discharge pressure override.

NOTE

The controller will not allow both unloader operations to happen at the same time, but stages the second unloader 30 seconds after the first if discharge pressure exceeds 330 psig.

2.3.7 Evaporator Fan Speed Selection

Temperature control is the primary method of determining the fan speed selection. The following table indicates relay operational status for the various fan motor states while Figure 2-1 provides Logic Board speed selections at various deviations from set point.

Table 2-1. Evaporator Fan Speed Relay Operation

STATE	HIGH SPEED RELAYS	EVAP FAN RELAY
Off	Off	Off
Low	Off	On
High	On	On

2.3.8 Condenser Fan Control

The condenser fans are energized when the compressor clutch output is energized. The fans are started in low speed and will remain in low speed until the discharge pressure increases to 190 PSIG. The fans will remain in high speed until discharge pressure decreases below 135 PSIG. The fans will also be activated if a high pressure alarm has been activated and operation has not been locked out (refer to Table 3-2).

2.3.9 Compressor Clutch Control

A belt driven electric clutch is employed to transmit engine power to the air conditioning compressor. De-energizing the clutch electric coil disengages the clutch and removes power from the compressor. The clutch will be engaged when in cooling and disengaged when the system is off, in heating or during high and low pressure conditions.

The clutch coil is prevented from engagement when the ambient temperature is below ambient lockout setpoint.

The clutch coil will be de-energized if the discharge pressure rises to the cutout setting of the compressor mounted high pressure switch. The clutch coil will energize when the discharge pressure falls to the reset point of the compressor mounted high pressure switch.

The clutch coil will be de-energized if the suction pressure decreases below 10 PSIG.

2.3.10 Liquid Line Solenoid Control

The liquid line solenoid is energized (open) when the compressor clutch is energized and de-energized (closed) when the clutch is not.

2.3.11 Alarm Description

Alarm descriptions and troubleshooting procedures are provided in section 3.

2.3.12 Hour Meters

Hour meter readings are available in the parameter code list of the Micromate. The hour meters record the compressor run time and the total time the evaporator fans are on. The maximum hours is 999,999. Refer to paragraph 3.3.2 for instructions on reading parameter codes.

SECTION 3

TROUBLESHOOTING

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

3.1 SELF DIAGNOSTICS

A self test is performed by the Micromax Logic Board each time the board is powered up. Errors, if any, will be indicated and the unit will not be allowed to start. The error codes can be read by counting the number of times that the Logic Board STATUS and CODE LED's (see Figure 1-10) flash simultaneously. The Micromate display will indicate errors with the code ER-#, where "ER" is the error prefix and # is the error number.

Table 3-1 Error Codes

CODE	NAME	DESCRIPTION
ER 1	Data Memory	Logic board data memory failure.
ER 2	Program Memory	Logic board program memory failure.
ER 3	A/D	A/D and multiplexer failure.
ER 4	Communication Failure	Failure in communication between the logic board and Micromate control panel.
ER 5	Program Memory	Display program memory failure.

3.1.1 System Parameters

Pressing the up/down arrow keys will allow the user to scroll up or down through the parameters. If no key is pressed for 30 seconds this mode is exited and the display will revert back to the default display. Pressing the on/off key any time will exit this mode and the display will again indicate the default. The parameters are shown in Table 3-4. When scrolling through the parameters, the current parameter will be displayed for two seconds. After two seconds, the display will show the data for the current parameter. When the last parameter is reached, the list will wrap back to P1.

3.2 SYSTEM ALARMS

3.2.1 Alarm Codes

The Micromax Logic Board continuously monitors system parameters and will generate an ALARM if a parameter exceeds preset limits. Alarms are indicated and the controller will respond in accordance with the information provided in Table 3-2. The alarm codes can be read by counting the number of times that the Logic Board CODE LED (see Figure 1-10) flashes. Flashing lights indicate active alarms. Each alarm code is a two digit number, the first set of flashes is the first digit and (after a slight pause) the second set of flashes is the second digit. The Micromate display will indicate alarms with the code A-## or i-##, where "A" is an active alarm prefix, "i" is an inactive alarm prefix and ## is the error number. If multiple alarms are present the user can scroll through each alarm by pressing the ARROW keys. When the end of the alarm list is reached the display will show "---". If the auto key is held down for five seconds while "---" is displayed all inactive alarms are cleared. A listing of alarm codes is provided in Table 3-2.

3.2.2 Activation

When alarms are detected, they are placed in an alarm queue in the order at which they initiated unless the alarm is already present. Each alarm recorded will also capture an evaporator hour meter reading corresponding to the activation time. If the AUTO key is pressed while an alarm is displayed, the activation time capture will be shown.

3.2.3 Alarm Queue

The alarm queue can hold 10 alarms. When the alarm queue is full the Logic Board will take the required action but the alarm will not be recorded. When this situation occurs, an "Alarm Queue Full"alarm will be generated. When the alarms are viewed this will be the first alarm to be shown.

3.2.4 Alarm Clear

The user may clear inactive alarms using the Micromate keypad. Refer to paragraph 3.2.1.

3.3 MICROPROCESSOR DIAGNOSTICS

The Micromate allows the user to interface with the microprocessor based control. This allows system parameters, alarms and settings to be viewed and modified.

The Micromate (Figure 1-8) will allow the user to interface with the microprocessor based control from the driver's control panel. The Micromate Display Panel (Figure 1-7) requires that the Micromate Diagnostic Service Tool (P/N 76-62124-01) will need to be used to access the system. The service tool plugs in to the Logic Module to Driver Display Harness located on the electrical control panel (Figure 1-11).

Table 3-2 Alarm Codes

ALARM NO.	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A12	High Voltage	The battery voltage is greater than 32 volts.	Check, repair or replace alternator.	The system is shut down until the voltage returns to normal levels.
A13	Low Voltage	The battery voltage is less than 17 volts.	Check, repair or replace wiring or alternator.	The system is shut down until the voltage returns to normal levels.
A14	Return Air Probe Failure	Return air temperature sensor failure or wiring defective.	Ensure all connectors are plugged in. Check sensor resistance or wiring. Refer to paragraph 4.13. Replace sensor or repair wiring.	All outputs except the evaporator fans will be de-energized.
A15	Suction Pressure Transducer Failure	Suction pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	Both unloaders are energized.
A16	Discharge Pressure Transducer Failure	Discharge pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	One unloader is energized.
A17	Low Pressure Shutdown	Low suction pressure (below 10 psig)	Check cause of low suction pressure. (Refer to section 3.4.3)	The clutch is de-energized for the minimum off time. The evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutes all outputs will be de-energized and the system is locked out until the power is cycled or the alarm is reset.
A21	High Discharge Pressure	High discharge pressure switch open or wiring defective.	Check discharge pressure transducer reading, wiring or cause of high discharge pressure. (Refer to section 3.4.3)	The clutch is de-energized for the minimum off time. The condenser and evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutes all outputs will be de-energized and the system is locked out until the power is cycled or the alarm is reset.

Table 3-2. Alarm Codes – Continued

ALARM NO	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A22	Breaker Trip Alarm	A breaker on the relay board has tripped or a fan relay has failed.	Check breakers for tripped device. Repair short and reset breaker.	Alarm will be generated.
A23	Evaporator Fan Overload	Evaporator fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A24	Condenser Fan Overload	Condenser fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A25	Motor Failure	A brushless motor has not reached full operating speed or a motor failure.	Replace motor	Alarm displayed and the motor fail output is energized.
A26	Not used			
A31	Maintenance Alarm 1	The compressor hour meter is greater than the value in Maintenance Hour Meter 1.	Reset the maintenance hour meter.	Alarm will be generated.
A32	Maintenance Alarm 2	The evaporator hour meter is greater than the value in Maintenance Hour Meter 2.	Reset the maintenance hour meter.	Alarm will be generated.
A99	Alarm Queue Full	All locations of the alarm queue are currently full and no more alarms can be saved.	Record and clear alarm queue.	Alarm will be generated.

3.3.1 Control

NOTE

1 This procedure should be performed by an HVAC technician who has been trained on Carrier system design. Control configuration is preset by the manufacturer.

2 If a replacement Logic Module is installed, it is necessary to match the configuration jumpers (see Figure 1-10) to the original board. Refer to paragraph 4.24.

a. Turn the A/C main power switch (located in the driver's area) to OFF.

b. Turn the A/C main power switch back to the ON position.

c. Activate the system by pressing the 1/0 key on the Micromate panel.

NOTE

When modifying the setpoint temperature for diagnostic purposes, be sure to reset the setpoint when testing is complete.

3.3.2 Diagnostic Mode

Diagnostic mode can be entered by pressing the up and down arrow keys simultaneously for 5 seconds. Diagnostic mode allows alarms and system parameters to be viewed. If there are any alarms stored, the most recent alarm will be shown. To view additional alarm information, refer to section 3. Press the up and down arrow keys to view parameters.

3.3.3 Test Mode

With the system in normal operation, the controller may be placed in the test mode, by doing the following:

a. Enter the diagnostic mode by pressing the up and down arrow keys simultaneously for 5 seconds. Enter the test mode by pressing the COOL key five times.

b. In the test mode, the display will read "T##" where "##" indicated the test number that is currently running.

c. The initial indication will be "T00". This indicates the controller is in the test mode and all relays are de–energized. Press the arrow keys to scroll through and perform each test When the highest test number is reached, the display will increment back to the lowest test number. A listing of tests is provided in Table 3-3.

d. To terminate testing, press the I/0 key.

Table 3-3. Controller Test List

TEST	OUTPUT	STATE
T00	All Relays	Off
T01	Evaporator High	On
T02	Evaporator Low	On
T03	Condenser High	On
T04	Condenser Low	On
T05	Compressor & Liquid Line Solenoid	On
T06	Unloader Valve 1	On
T07	Unloader Valve 2	On
T08	Not Applicable	On
T09	Reheat Coolant Valve	On
T10	Fault	On
T11	Boost	On
T12	Spare/Motor Input/	On

Table 3-4. Parameter Codes

CODE	CODE NAME	DESCRIPTION
P1	Return Air Temperature	This value is the temperature measured by the return air sensor. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP.*
P2	Coil Temperature	Not used.
P3	Ambient Temperature	This value is the outside temperature measured by the ambient temperature sensor. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP.*
P4	Suction Line Temperature	This value is the temperature of the refrigerant gas leaving the evaporator coil. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP.*
P5	Suction Pressure	This value is the suction pressure measured by the suction pressure transducer. If the sensor is shorted it will display *CL* If it is open circuited it will display *OP.*
P6	Discharge Pressure	This value is the discharge pressure measured by the discharge pressure transducer. If the sensor is shorted it will display “CL” and if it is open circuited it will display “OP”.
P7	Superheat	This value is calculated by the Micro Max using values P4 and P5.
P8	Analog Set Point Temperature	Not used.
P9	A/C Control Window #1	This is the number of degrees F above setpoint at which the unloaders will be both energized. This value can be modified between 0 and 10 degrees F. The default value is 2 degrees F.
P10	A/C Control Window #2	This is the number of degrees F above AC control window one at which the first unloader will be energized. This value can be modified between 0 and 10 degrees F. The default value is 2 degree F.
P11	A/C Control Window #3	This is the number of degrees F above AC control window two at which the evaporator fan speed will be set to low. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.
P12	Heat Control Window	This is the number of degrees F below setpoint before the EHV is energized. This value can be modified between 0 and 10 degrees F. The default value is 2 degree F for heat and 4 degrees F for reheat.
P13	Compressor Safety Off Delay	This number is the minimum time in minutes that the compressor must be off after a high or low pressure alarm before it can be restarted. This value can be modified between one and five minutes. The default value is 1.
P14	Fan Delay	This is the minimum time (in seconds) that the fans must run at a particular speed before changing to another speed. This value can be modified between one and 60 seconds. The default value is two seconds.

Table 3-4. Parameter Codes – Continued

CODE	CODE NAME	DESCRIPTION
P15	Reheat Valve Delay	This is the minimum time (in seconds) that the reheat valve must be in a particular state (open /closed) before changing to another state. This value can be modified between 1 and 60 seconds. The default value is 2 seconds.
P16	Compressor High Pressure Switch	This is the current state of the compressor high pressure switch input. “CL” will be displayed if it is closed and “OP” will be displayed if it is open.
P17	Condenser Fan Speed Switch	Not used.
P18	Maximum Setpoint	This is the maximum value that the operator will be allowed to set the setpoint temperature. The value can be modified in degrees with the up and down keys to a value between 60°F and 80°F. The system default is 80°F.
P19	Minimum Setpoint	This is the minimum value that the operator will be allowed to set the setpoint temperature. The value can be modified in degrees with the up and down keys to a value between 60°F and 80°F. The system default is 60°F.
P20	Compressor Hours High	This is the number of hours of operation that the compressor has run with the clutch energized in thousands
P21	Compressor Hours Low	This is the number of hours of operation that the compressor has run with the clutch energized in hundreds, tens and ones.
P22	Evaporator Hours High	This is the number (in thousands) of hours of operation with the evaporator fans energized.
P23	Evaporator Hours Low	This is the number (in hundreds, tens and ones) of hours of operation with the evaporator fans energized.
P24	Maintenance 1 Hour High	This is the value of compressor hours high (P20) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P25	Maintenance 1 Hour Low	This is the value of compressor hours low (P21) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P26	Maintenance 2 Hours High	This is the value of evaporator fan hours high (P22) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P27	Maintenance 2 Hours Low	This is the value of evaporator fan hours low (P23) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P28	Freeze Alarm Setting	Not used.
P29	Relay Module Voltage	This is the voltage being supplied to the relay module.
P30	Main Board Software Version	This is the software version of the logic board.
P31	Display Software Version	This is the software version of the display module.
P32	Ki	Not used.
P33	Kp	Not used.
P34	Default Display	This is the value displayed on the Micromate control panel. It is set to OFF to display set point temperature or set to ON to display return air temperature. This feature is available in software revision 1.9 and later.

3.4 TROUBLESHOOTING

General procedures for system troubleshooting are provided in Table 3-5

Table 3-5. General System Troubleshooting Procedures

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.4.1 System Will Not Cool		
Compressor will not run	Active system alarm V-Belt loose or defective Clutch coil defective Clutch malfunction Compressor malfunction	3.2 Check Check/Replace Check/Replace See Table 1-2
Electrical malfunction	Coach power source defective Circuit Breaker/safety device open	Check/Repair Check/Reset
3.4.2 System Runs But Has Insufficient Cooling		
Compressor	V-Belt loose or defective Compressor valves defective	Check See Table 1-2
Refrigeration system	Abnormal pressures No or restricted evaporator air flow Expansion valve malfunction Restricted refrigerant flow Low refrigerant charge Service valves partially closed Safety device open Liquid solenoid valve stuck closed	3.4.3 3.4.6 3.4.7 4.10 4.7 Open 1.7 Check
Restricted air flow	No evaporator air flow or restriction	3.4.6
Heating system	Reheat coolant valve stuck open	3.4.8
3.4.3 Abnormal Pressures		
High discharge pressure	Discharge transducer failure Refrigerant overcharge Noncondensable in system Condenser motor failure Condenser coil dirty	Replace 4.7.1 Check Check Clean
Low discharge pressure	Discharge transducer failure Compressor valve(s) worn or broken Low refrigerant charge	See Note. See Table 1-2 4.7
High suction pressure	Compressor valve(s) worn or broken	See Table 1-2
Low suction pressure	Suction service valve partially closed Filter-drier inlet valve partially closed Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction Restricted air flow Suction transducer failure	Open Check/Open 4.10 4.7 3.4.7 3.4.6 Replace
Suction and discharge pressures tend to equalize when system is operating	Compressor valve defective	See Table 1-2
3.4.4 Abnormal Noise Or Vibrations		
Compressor	Loose mounting hardware Worn bearings Worn or broken valves Liquid slugging Insufficient oil Clutch loose, rubbing or is defective V-belt cracked, worn or loose Dirt or debris on fan blades	Check/Tighten See Table 1-2 See Table 1-2 3.4.7 4.12.2 Check Check/Adjust Clean

Table 3-5 General System Troubleshooting Procedures – Continued

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.4.4 Abnormal Noise Or Vibrations – Continued		
Condenser or evaporator fans	Loose mounting hardware Defective bearings Blade interference Blade missing or broken	Check/Tighten Replace Check Check/Replace
3.4.5 Control System Malfunction		
Will not control	Sensor or transducer defective Relay(s) defective Microprocessor controller malfunction Logic Board J3 connector unplugged	4.13 or 4.14 Check Check Check
3.4.6 No Evaporator Air Flow Or Restricted Air Flow		
Air flow through coil blocked	Coil frosted over Dirty coil Dirty filter	Defrost coil Clean Clean/Replace
No or partial evaporator air flow	Motor defective Motor brushes defective Evaporator fan loose or defective Fan damaged Return air filter dirty Icing of coil Fan relay defective Safety device open Fan rotation incorrect	Repair/Replace Replace Repair/Replace Repair/Replace Clean/Replace Clean/Defrost Check/Replace 1.7 Check
3.4.7 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge Wax, oil or dirt plugging valve orifice Ice formation at valve seat Power assembly failure Loss of bulb charge Broken capillary tube	4.7 Check 4.6 Replace Replace 4.11
Low superheat and liquid slugging in the compressor	Bulb is loose or not installed. Superheat setting too low Ice or other foreign material holding valve open	4.11 4.11
Side to side temperature difference (Warm Coil)	Wax, oil or dirt plugging valve orifice Ice formation at valve seat Power assembly failure Loss of bulb charge Broken capillary	Check 4.6 Replace Replace 4.11
3.4.8 Heating Malfunction		
Insufficient heating	Dirty or plugged heater core Reheat coolant solenoid valve(s) malfunctioning or plugged Low coolant level Hand valve(s) closed Water pumps defective Auxiliary Heater malfunctioning.(if equipped)	Clean Check/Replace Check Open Repair/Replace Repair/Replace
No Heating	Reheat coolant solenoid valve(s) malfunctioning or plugged Controller malfunction Pump malfunctioning Safety device open	Check/Replace Replace Repair/Replace 1.8
Continuous Heating	Reheat coolant solenoid valve stuck open	Replace

SECTION 4

SERVICE

WARNING

BE SURE TO OBSERVE WARNINGS LISTED IN THE SAFETY SUMMARY IN THE FRONT OF THIS MANUAL BEFORE PERFORMING MAINTENANCE ON THE HVAC SYSTEM

WARNING

READ THE ENTIRE PROCEDURE BEFORE BEGINNING WORK. PARK THE COACH ON A LEVEL SURFACE, WITH PARKING BRAKE APPLIED. TURN MAIN ELECTRICAL DISCONNECT SWITCH TO THE OFF POSITION.

NOTE

Following completion of all maintenance or service activities, the alarm queue should be cleared of any original alarms and any alarms generated during service. Refer to paragraph 3.2.4.

4.1 MAINTENANCE SCHEDULE

SYSTEM ON	SYSTEM OFF	OPERATION	REFERENCE paragraph
a. Daily Maintenance			
X		Pre-trip Inspection – after starting	2.2
	X	Check tension and condition of V-belt	None
b. Weekly Inspection			
	X	Perform daily inspection	4.1.a
	X	Check condenser, evaporator coils and air filters for cleanliness	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.5
X		Feel filter-drier for excessive temperature drop across drier	4.10.1
c. Monthly Inspection and Maintenance			
	X	Perform weekly inspection and maintenance	4.1.b
	X	Clean evaporator drain pans and hoses	None
	X	Check wire harnesses for chafing and loose terminals	Replace/Tighten
	X	Check fan motor bearings	None
	X	Check compressor mounting bolts for tightness	None
	X	Check fan motor brushes	4.18, 4.22

4.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves (See Figure 4-1) used on the compressor are equipped with mating flanges for connection to flanges on the compressor. These valves are provided with a double seat and a gauge connection, which allows servicing of the compressor and refrigerant lines.

Turning the valve stem counterclockwise (all the way out) will *backseat* the valve to open the suction or discharge line to the compressor and close off the gauge connection. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated when connecting the service manifold gauge lines to the gauge ports.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to close off the suction or discharge line to isolate the compressor and open the gauge connection.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise 1/4 to 1/2 turn. With the valve stem midway between frontseated and backseated positions, the suction or discharge line is open to both the compressor and the gauge connection.

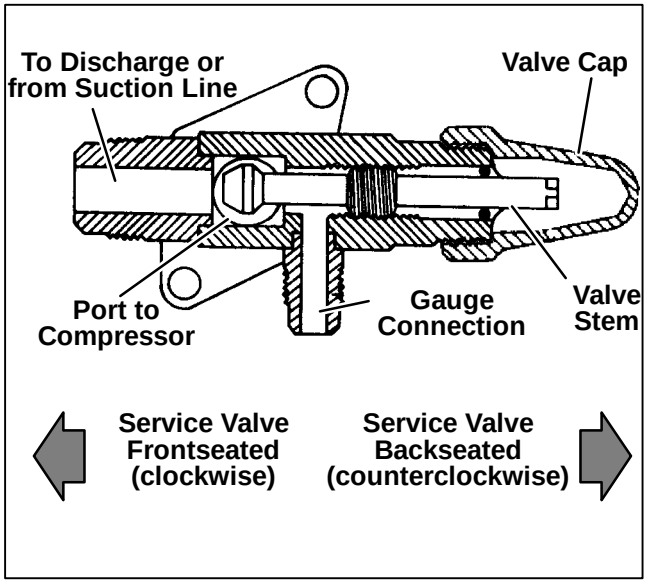


Figure 4-1. Suction or Discharge Service Valve

4.3 INSTALLING MANIFOLD GAUGES

The manifold gauge (Figure 4-2) set can be used to determine system operating pressures, add charge, equalize or evacuate the system.

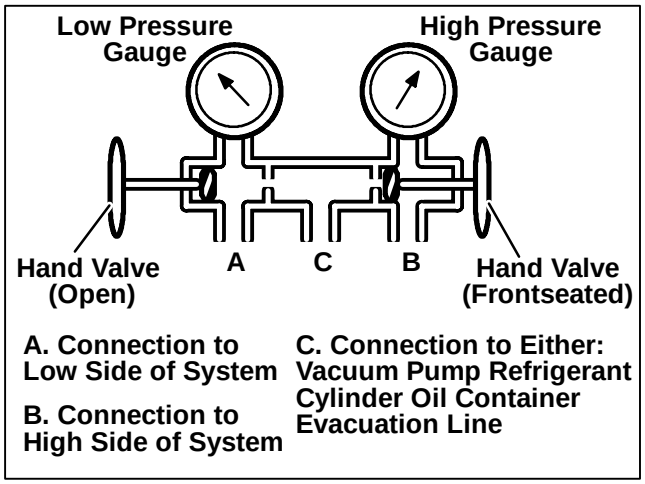

Low Pressure Gauge
High Pressure Gauge
Hand Valve (Open)
A
C
B
Hand Valve (Frontseated)
A. Connection to Low Side of System
B. Connection to High Side of System
C. Connection to Either: Vacuum Pump Refrigerant Cylinder Oil Container Evacuation Line

Figure 4-2. Manifold Gauge Set

The manifold gauge set (Figure 4-2) is equipped with hand valves, gauges and refrigerant openings. When the low pressure hand valve is frontseated (turned all the way in), the low (evaporator) pressure can be checked. When the high pressure hand valve is frontseated, high (condensing) pressure can be checked. When both valves are open (turned counterclockwise), high pressure vapor will flow into the low side. When the low pressure valve is open, the system can be charged or evacuated. Oil can also be added to the system.

Install the manifold gauge set as follows:

a. Remove both service valve stems and service port caps. Backseat (counterclockwise) both service valves.

b. Connect the high side hose *tightly* to discharge service valve port.

c. Connect the low side hose *loosely* to suction service valve port.

d. Loosen charging (center) hose at dummy fitting of manifold set.

e. Frontseat (clockwise) both manifold gauge hand valves.

f. Open discharge service valve counterclockwise approximately 1/4 to 1/2 turn.

g. Slowly open (counterclockwise) manifold discharge hand valve approximately one turn.

h. Tighten charging hose onto dummy fitting.

i. Slowly open the manifold suction hand valve to remove air from line.

j. Tighten suction hose at the suction service valve port.

k. Frontseat (close) both manifold hand valves.

l. Open suction service valve counterclockwise approximately 1/4 to 1/2 turn.

4.4 PUMPING THE SYSTEM DOWN OR REMOVING THE REFRIGERANT CHARGE

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

4.4.1 System Pumpdown

To service or replace the filter-drier, expansion valve, evaporator coil, or suction line, pump the refrigerant into condenser coil and receiver as follows:

a. Install manifold gauge set. (Refer to paragraph 4.3.)

b. Unplug the suction pressure transducer(SPT).

NOTE

The following procedure may have to be repeated several times to maintain the 1 psig *(6.9 kPa)* pressure depending upon amount of refrigerant absorbed in the oil.

c. Frontseat filter-drier inlet service valve by turning clockwise. Shut off the parcel evaporator liquid line shut off valve. Start system and run in cooling. Stop the unit when the suction pressure reaches a slight vacum (1–2"/hg). Allow pressure to stabilize to 2 psig *(13.8 kPa)* to maintain a slight positive pressure.

d. Frontseat (close) suction service valve to trap the refrigerant in the high side of the system between the compressor suction service valve and the filter drier inlet valve. The low side of the system will now be at 2 psig *(13.8 kPa)* pressure and ready for servicing,

e. Service or replace the necessary component on the low side of the system.

f. Leak check connections. (Refer to paragraph 4.5.)

g. Evacuate and dehydrate the low side. (Refer to paragraph 4.6.)

h. Reconnect the suction pressure transducer(SPT).

4.4.2 Removing the Refrigerant Charge

Connect a refrigerant recovery system to the unit near the receiver to remove refrigerant charge. (Refer to Figure 4-4.) Refer to instructions provided by the manufacturer of the refrigerant recovery system.

NOTES

1. Before opening up any part of the system, *a slight positive pressure should be indicated on the gauge.*

2. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling; this avoids internal condensation, which puts moisture into the system.

4.4.3 Refrigerant Removal From An Inoperative Compressor.

To remove the refrigerant from a compressor that is not operational, do the following:

a. Attach a manifold gauge set as shown in Figure 4-3 and isolate the compressor by frontseating the suction and discharge valves.

b. Recover refrigerant with a refrigerant reclaimer. If the discharge service valve port is not accessible, it will be necessary to recover refrigerant through the suction service valve port only.

c. Service or replace components as required and leak check the entire system.

d. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to or below 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds at or below 500 microns.

e. Once vacuum is maintained, recharge high side with R-134a to proper charge. Backseat compressor service valves and disconnect manifold gauge set.

4.4.4 Pump Down An Operable Compressor For Repair

To service an operable compressor, pump the refrigerant into the condenser coil and receiver as follows:

a. Install manifold gauge set. Refer to Figure 4-3.

b. Unplug the suction pressure transducer(SPT).

c. Frontseat the compressor suction service valve by turning clockwise.

d. Start the unit and run in cooling until a slight vacuum (1–2") is reached. Shut the system down and tag out system power source.

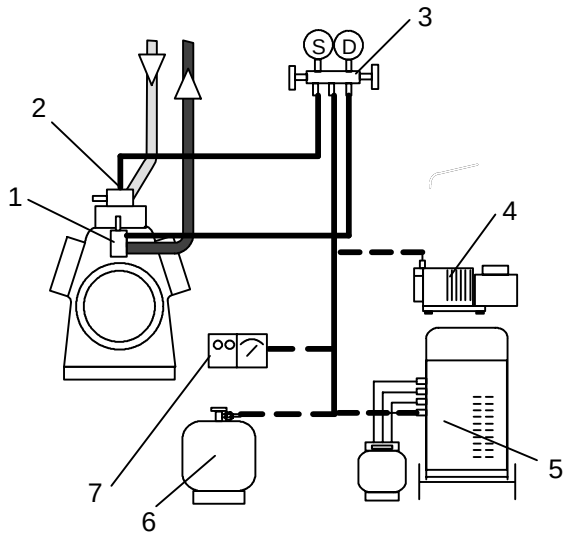
e. Frontseat the compressor discharge service valve and wait 5 minutes to verify vacuum is maintained. If the pressure rises above vacuum, open the compressor discharge service valve and repeat steps c. and d .until a vacuum is maintained.

f. Service or replace components as required and leak check the entire system.

g. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to to below 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds at or below 500 microns.

h. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.

i. Reconnect the suction pressure transducer(SPT).



1. Discharge Service Valve and Port
2. Suction Service Valve and Port
3. Manifold Gauge Set
4. Vacuum Pump
5. Recycle/Recovery Machine
6. Refrigerant Cylinder
7. Thermistor Vacuum Gauge

Figure 4-3. Compressor Service Connections

4.5 REFRIGERANT LEAK CHECK

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component.

To check for leaks in the refrigeration system, perform the following procedure:

NOTE

It must be emphasized that only the correct refrigerant drum should be connected to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional evacuation and evacuation of the high (discharge) side of the system.

a. Ensure the main liquid line and driver solenoid valves are open.

b. If system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 psig *(207 to 345 kPa).*

c. Add sufficient nitrogen to raise system pressure to 150 to 200 psig *(1.03 to 1.4 mPa).*

d. Check for leaks. The recommended procedure for finding leaks in a system is with an electronic leak detector. Testing joints with soapsuds is satisfactory and may be necessary under conditions when an electronic leak detector will not function correctly.

e. Remove refrigerant from system and repair any leaks.

f. Evacuate and dehydrate the system. (Refer to paragraph 4.6.)

g. Charge the unit. (Refer to paragraph 4.7.)

h. Ensure that self-test has been performed and that there are no errors or alarms indicated. (Refer to paragraph 2.1.4)

4.6 EVACUATION AND DEHYDRATION

4.6.1 General

The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices by free water, and formation of acids, resulting in metal corrosion.

4.6.2 Preparation

NOTE

Using a compound gauge for determination of vacum level is not recommended because of its inherent inaccuracy, a calibrated vacuum gage is recommended.

NOTE

Using six foot long charging hoses will simplify the evacuation/charging procedures that follow.

NOTE

Never evacuate a refrigerant system with an open drive compressor below 500 microns.

a. Evacuate and dehydrate only after a refrigerant leak check. (Refer to paragraph 4.5.)

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump with a minimum of 6 cfm *(10.2 m^3/hr)* volume displacement (CTD P/N 07-00176-11), and a good vacuum indicator (CTD P/N 07-00414-00).

c. Keep the ambient temperature above 60_F *(15.6_C)* to speed evaporation of moisture. If ambient temperature is lower than 60_F *(15.6_C)*, ice may form before moisture removal is complete. It may be necessary to use heater blankets, heat lamps or alternate sources of heat to raise system temperature.

4.6.3 Procedure for Evacuation and Dehydrating System

a. Remove refrigerant using a refrigerant recovery system.

b. Evacuation should be performed through three ports in the refrigeration system. The hoses should be connected to the compressor suction and discharge service ports, and to the liquid line shut off valve.(Figure 4-4)

c. Connect lines to unit and manifold and make sure vacuum gauge valve is closed and vacuum pump valve is open.

d. Open solenoid valves electrically to ensure a good vacuum is obtained.

e.. Start vacuum pump. Slowly open valves halfway and then open vacuum gauge valve.

f.. Evacuate unit until vacuum gauge indicates 500 microns (29.90 inches = 75.9 cm Hg vacuum). Close gauge valve, vacuum pump valve, and stop vacuum pump.

g. Break the vacuum with clean dry refrigerant. Use refrigerant that the unit calls for. Raise system pressure to approximately 2 psig *(13.8 kPa).*

h. Remove refrigerant using a refrigerant recovery system.

i. Repeat steps e, f, g, and h one time.

j. Start vacuum pump and open all valves. Dehydrate unit to 500 microns (29.90 inches = 75.9 cm Hg vacuum).

k. Close off pump valve, isolate vacuum gauge in system and stop pump. Wait five minutes to see if vacuum holds.

l. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

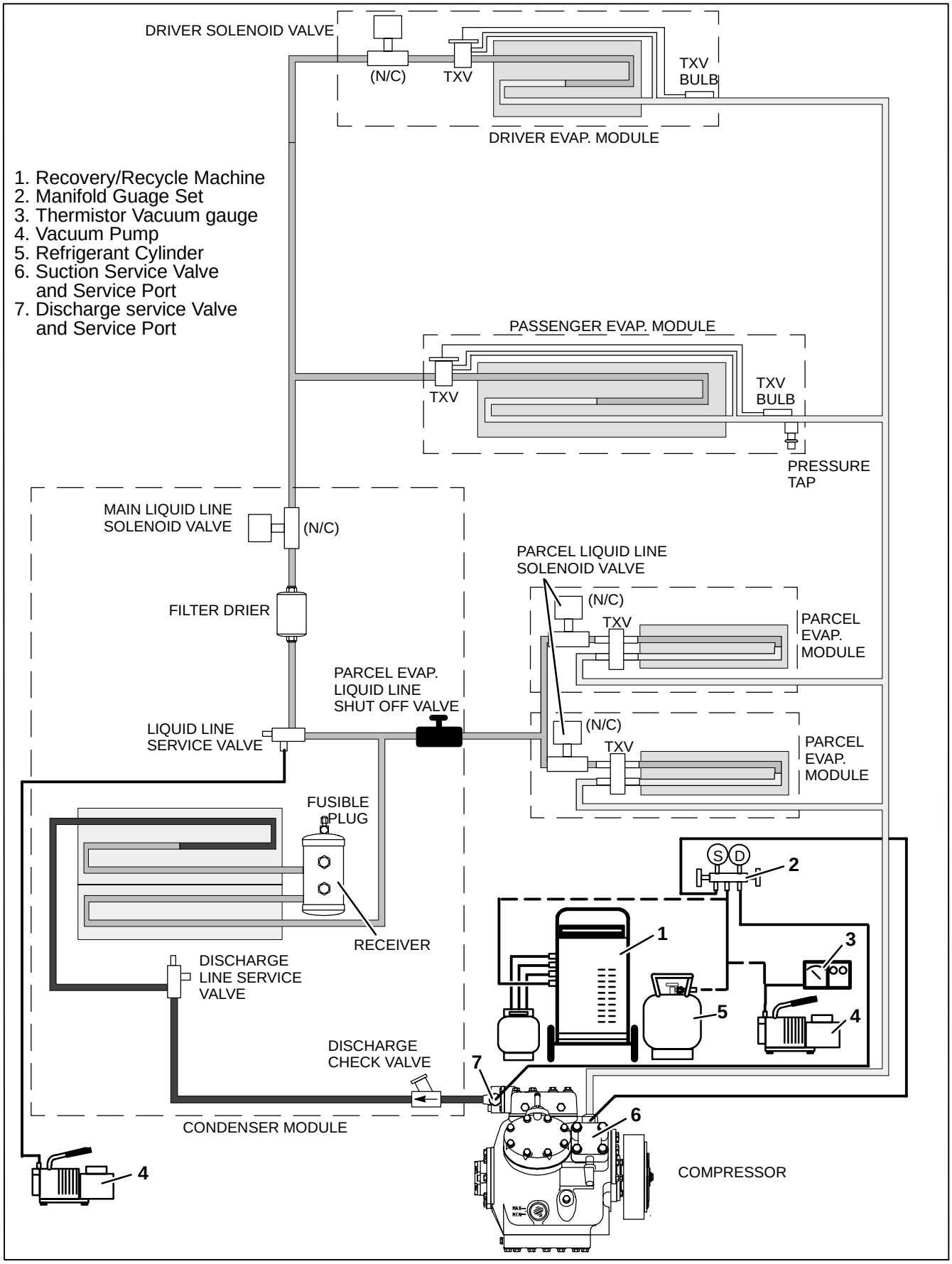


Figure 4-4. Refrigerant Service Connections

4.7 ADDING REFRIGERANT TO SYSTEM

4.7.1 Checking Refrigerant Charge

The following conditions must be met to accurately check the refrigerant charge.

a. Coach engine operating at high idle.

b. Unit operating in cool mode for at least 15 minutes.

c. Discharge pressure at least 150 psig *(1.03 mPa)* for R-134a systems. (It may be necessary to block condenser air flow to raise discharge pressure.)

Under the above conditions, the system is properly charged when the bottom receiver sight glass appears half full with refrigerant. If the bottom sight glass is not half full, add or remove refrigerant charge to the proper level.

4.7.2 Adding Full Charge

a. Evacuate and dehydrate system. (Refer to paragraph 4.6.)

b. Place appropriate refrigerant cylinder on scales and connect charging hose from container to filter-drier inlet valve. Remove air from hoses.

c. Note weight of refrigerant and container.

d. Open liquid valve on refrigerant container. Midseat filter-drier inlet valve and allow refrigerant to flow into the unit. Refer to paragraph 1.4 for correct charge.

e. When drum weight (scale) indicates that the correct charge has been added, close liquid line valve on drum and backseat the filter-drier inlet valve.

NOTES

The following conditions must be met to accurately check the refrigerant level:

1. Coach engine must be operating at high idle speed.

2. Unit must be operating in the cool mode for at least 15 minutes.

3. Discharge pressure must be at least 150 psig *(1.0 mPa)*. (It may be necessary to block condenser airflow to raise discharge pressure.)

f. Under the above conditions, the system is properly charged when the refrigerant liquid level is visible in the receiver lower sight glass. If it is not visible, add or remove refrigerant until it is at the proper level.

4.7.3 Adding Partial Charge

a. Start the vehicle engine and allow unit to stabilize.

b. Place appropriate refrigerant cylinder on scales and connect charging hose from container vapor valve to compressor suction service valve.

NOTE

The following conditions must be met to accurately check the refrigerant level:

1. Coach engine must be operating at high idle speed.

2. Unit must be operating in the cool mode for at least 15 minutes.

3. Discharge pressure must be at least 150 psig *(1.0 mPa)*. (It may be necessary to block condenser airflow to raise discharge pressure.)

c. Run unit in cool mode for 15 minutes. With suction service valve midseated, remove air from hose at refrigerant cylinder. Open cylinder valve and add vapor charge until refrigerant level appears in the lower receiver sight glass. Under the above conditions, the system will be properly charged when the lower receiver sight glass appears full of refrigerant. Add or remove refrigerant until the proper level is obtained. ***Refrigerant level should not appear in the upper sight glass, as this would indicate an overcharge.***

d. Backseat suction service valve. Close vapor valve on refrigerant drum and note weight. Replace all valve caps.

4.8 CHECKING FOR NONCONDENSIBLES

To check for noncondensibles, proceed as follows:

a. Stabilize system to equalize pressure between the suction and discharge side of the system.

b. Check temperature at the condenser and receiver.

c. Check pressure at the compressor discharge service valve.

d. Check saturation pressure as it corresponds to the condenser/receiver temperature using the Temperature-Pressure Chart, Table 4-5.

e. If gauge reading is 3 psig *(21 kPa)* or more than the calculated P/T pressure in step d., noncondensibles are present.

f. Remove refrigerant using a refrigerant recovery system.

g. Evacuate and dehydrate the system. (Refer to paragraph 4.6.)

h. Charge the unit. (Refer to paragraph 4.7.)

4.9 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH

4.9.1 Checking High Pressure Switch

WARNING

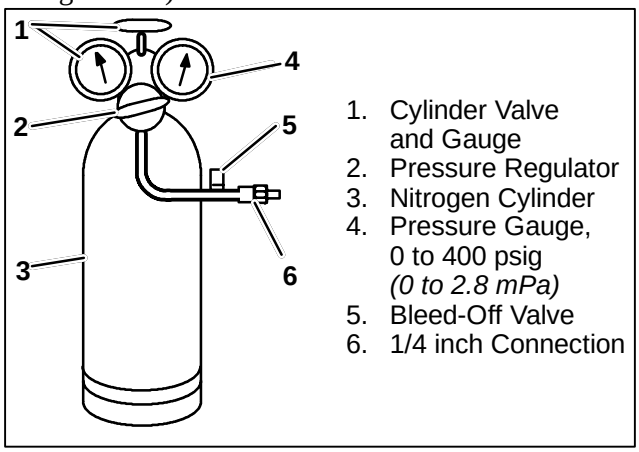
DO NOT USE A NITROGEN CYLINDER WITHOUT A PRESSURE REGULATOR

DO NOT USE OXYGEN IN OR NEAR A REFRIGERATION SYSTEM AS AN EXPLOSION MAY OCCUR.

a. Remove switch from unit. All units are equipped with schrader valves at the high pressure switch connection.

b. Connect an ohmmeter across switch terminals. If the switch is good, the ohmmeter will indicate no resistance, indicating that the contacts are closed.

c. Connect switch to a cylinder of dry nitrogen. (See Figure 4-5.).



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge, 0 to 400 psig *(0 to 2.8 mPa)*
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 4-5. Checking High Pressure Switch

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. (See paragraph 1.4.)

e. Open cylinder valve. Slowly open the regulator valve to increase the pressure until it reaches cutout point. The switch should open, which is indicated by an infinity reading on an ohmmeter (no continuity).

f. Close cylinder valve and release pressure through the bleed-off valve. As pressure drops to cut-in point, the switch contacts should close, indicating no resistance on the ohmmeter.

g. Replace switch if it does not function as outlined above. (Refer to paragraph 4.9.2.)

4.9.2 Replacing High Pressure Switch

a. The high pressure switch is equipped with schrader valve to allow removal and installation without pumping the unit down.

c. Disconnect wiring from defective switch.

d. Install new cutout switch.

e. Check switch operation. (Refer to paragraph 4.9.1.)

4.10 FILTER-DRIER

4.10.1 To Check Filter Drier

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the filter-drier. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

4.10.2 To Replace Filter Drier

a. Install a manifold gauge set to the liquid line shut off valve. (Refer to paragraph 4.3.)

b. Start the system.

c. Front seat the liquid line service valve.(See Figure 4-4.)

d. Shut the system down when the indicated pressure reaches 1 psig. The liquid line solenoid valve will close when the system shuts down, sealing the filter drier from the rest of the system.

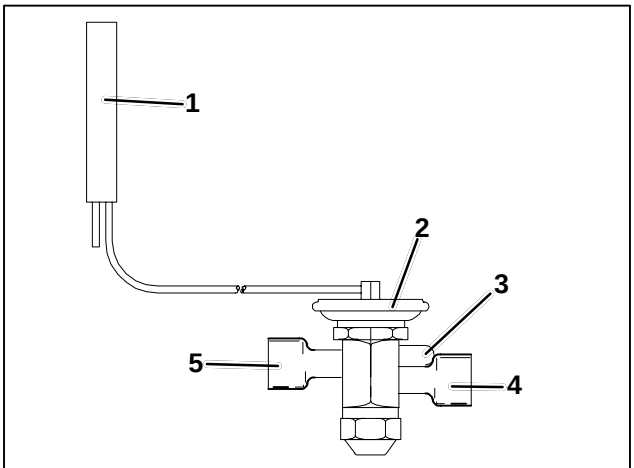
e. Replace the filter drier, ensuring that the arrow points in the direction of the refrigerant flow.

f. Drier can be evacuated at liquid line service valve. (See Figure 4-4.)

g. Check refrigerant level. (Refer to paragraph 4.7.1.)

4.11 THERMOSTATIC EXPANSION VALVE

The thermostatic expansion valve (TXV) is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant returning to the compressor. Unless the valve is defective, it seldom requires any maintenance.



1. Bulb
2. Power Head Assembly
3. Equalizer Connection
4. Outlet Connection
5. Inlet Connection

Figure 4-6. Thermostatic Expansion Valve

4.11.1 Replacing the Power Head/Bulb Assembly (See Figure 4-6.)

In the event that the power head and/or the bulb and capillary tube loses its charge due to physical damage, it(powerhead/cap tube/bulb assembly) can be replaced.

a. Pump down low side of the unit. (Refer to paragraph 4.4.)

b. Remove insulation (Presstite) from expansion valve bulb.

c. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.

d. Carefully, with two wrenches, one one the power head and the other on the valve body, loosen the power head assembly and remove from valve body.

e. Check for debris in valve and clean if necessary.

f. Carefully install the new power head/cap tube/bulb assembly, paying particular caution to the cap tube/bulb as the head is rotated on to the valve body.

g. The thermal bulb is installed below the center of the suction line (four or eight o'clock position). This area must be clean to ensure positive bulb contact. Clean the suction line with sandpaper or emery cloth before installing bulb to ensure proper heat transfer. Strap thermal bulb to suction line and insulate both with "Presstite." Ensure that retaining straps are tight. (See Figure 4-8.)

h. Evacuate and dehydrate. (Refer to paragraph 4.6.)

i. Open filter-drier inlet valve (liquid line service valve) and all service valves.

j.Run the coach for approximately 30 minutes on fast idle.

k.Check refrigerant level. (Refer to paragraph 4.7.1.)

l.Check superheat. (Refer to paragraph 4.11.3.)

4.11.2 Replacing the Expansion Valve (See Figure 4-6.)

a. Pump down low side of the unit. (Refer to paragraph 4.4.)

b. Remove insulation (Presstite) from expansion valve bulb.

c. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.

NOTE

Always purge the refrigerant system with an inert gas such as nitrogen before proceeding with any brazing operation.

d. Unbraze the copper straps that secure the refrigerant line on each side of the TXV to the coil.

e. Disconnect the liquid line at the bulkhead connection and at the parcel rack connection.

f. Unbraze the equalizer connection, the outlet connection, then the inlet connection. Be careful to protect any insulation and wiring that are in the area.

g. Braze inlet connection to the liquid line.

h. Braze outlet connection to the evaporator.

i. Braze equalizer line to the equalizer connection.

j. The thermal bulb is installed below the center of the suction line (four or eight o'clock position). This area must be clean to ensure positive bulb contact. Clean the suction line with sandpaper or emery cloth before installing bulb to ensure proper heat transfer. Apply thermal grease to the indentation in the suction line. Strap thermal bulb to suction line and insulate both with "Presstite." Ensure that retaining straps are tight. (See Figure 4-8.)

k. Evacuate and dehydrate. (Refer to paragraph 4.6.)

l. Open filter-drier inlet valve (liquid line service valve) and all service valves.

m.Run the coach for approximately 30 minutes on fast idle.

n.Check refrigerant level. (Refer to paragraph 4.7.1.)

o.Check superheat. (Refer to paragraph 4.11.3.)

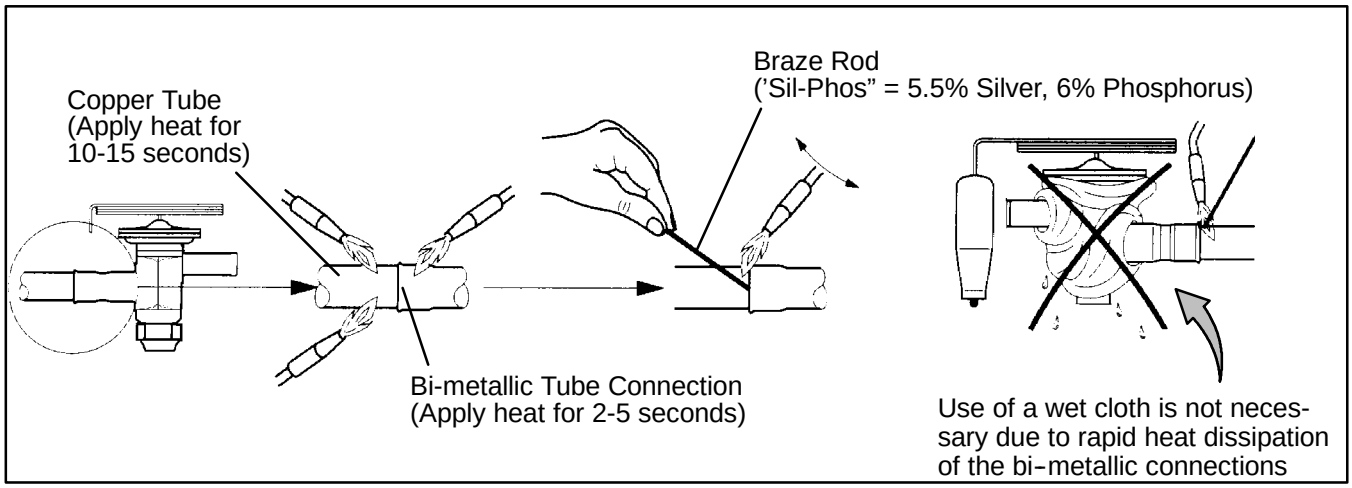
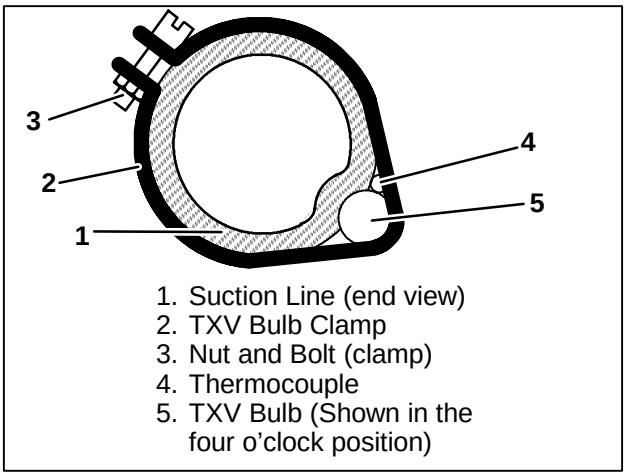

Braze Rod
('Sil-Phos" = 5.5% Silver, 6% Phosphorus)
Copper Tube
(Apply heat for
10-15 seconds)
Bi-metallic Tube Connection
(Apply heat for 2-5 seconds)
Use of a wet cloth is not necessary due to rapid heat dissipation of the bi-metallic connections

Figure 4-7. Hermetic Thermostatic Expansion Valve Brazing Procedure



1. Suction Line (end view)
2. TXV Bulb Clamp
3. Nut and Bolt (clamp)
4. Thermocouple
5. TXV Bulb (Shown in the four o'clock position)

Figure 4-8. Thermostatic Expansion Valve Bulb and Thermocouple Installation

4.11.3 To Check/Measure Superheat

The Micromate Control Panel can give this value. (Refer to paragraph 3.1.1) The alternate method is desribed as follows:

NOTE

All readings must be taken from the suction side area of the evaporator near the TXV and out of the direct air stream.

a. Remove passenger evap. access door.

b. Remove Presstite insulation from expansion valve bulb and suction line.

c. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

d. Place temperature thermocouple in contact with the suction tube and parallel to the TXV bulb, and then secure loosened clamp making sure both bulbs are firmly secured to suction line. (See Figure 4-8.) Reinstall insulation around the bulb.

e. Reinstall evaporator access door being careful to route thermocouple sensing wire outside the evaporator.

f. Connect an accurate low pressure gauge to the 1/4" port on the suction line within the passenger evaporator compartment.

g. Start coach and run on fast idle until unit has stabilized, about 20 to 30 minutes.

h. From the temperature/pressure chart, determine the saturation temperature corresponding to the evaporator outlet pressure. (See Table 4-5.) Add an estimated suction line loss of 2 psig *(13.8 kPa)* to the number.

i. Note the temperature of the suction gas at the expansion valve bulb. Subtract the saturation temperature determined in step h. from the temperature measured in this step. The difference is the superheat of the suction gas.

j. Repeat steps h. and i. six times at three minute intervals and average the six readings to determine average superheat. Average superheat should be 12 to 18_F *(6.7 to 10.1_C)*.

4.12 MODEL 05G COMPRESSOR MAINTENANCE

4.12.1 Removing the Compressor

If compressor is inoperative and the unit still has refrigerant pressure, isolate the compressor and remove the refrigerant. Refer to paragraph 4.4.3.

If compressor is operative, perform a pump down. (Refer to paragraph 4.4.4.)

a. Turn main battery disconnect switch to OFF position.

b. Loosen bolts at suction and discharge service valve flanges and break seal to be sure pressure is released.

c. Remove bolts from suction and discharge service valve flanges.

d. Tag and disconnect wiring to the high pressure cutout switch, discharge pressure transducer, suction pressure transducer, unloaders and the clutch.

g. Remove four bolts holding compressor to base.

h. Attach sling or other device to the compressor and remove compressor from the coach through the right rear access door.

i. Remove the three socket head capscrews from both unloader valves on the side heads of the 05G compressor. Remove the unloader valve and bypass piston assembly, keeping the same capscrews with the assembly. (See Figure 4-9.) The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head capscrew into top of piston. A small Teflon seat ring at the bottom of the piston must be removed.

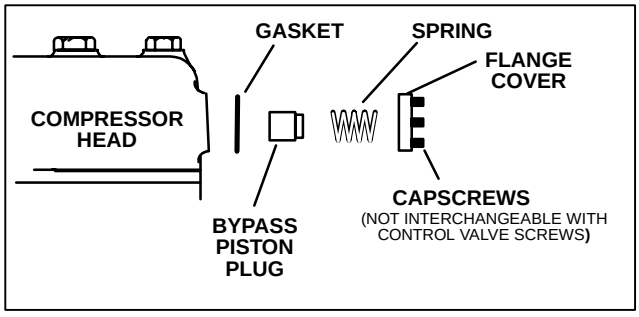


Figure 4-9. Removing Bypass Piston Plug

NOTES

1. The service replacement 05G compressors are sold without shutoff valves. Valve pads are installed in their place. The optional unloaders are not supplied, as the cylinder heads are shipped with plugs. The customer should retain the original unloader valves for use on the replacement compressor.

2. The piston plug that is removed from the replacement compressor head must be installed in the failed compressor if returning for warranty.

3. Do not interchange allen head capscrews that mount the piston plug and unloader; they are not interchangeable.

4. Check oil level in service replacement compressor. (Refer to paragraph 4.12.2.)

5. Service replacement compressors are supplied with a suction filter sock for initial startup. Ensure the filter sock is installed and removed in accordance with the instructions furnished.

j. Remove the high pressure switch and pressure transducer assemblies and install on replacement compressor after checking switch operation.

k. Install compressor into the coach by performing steps c. through h. in reverse sequence. It is recommended that new locknuts be used when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly.

l. Unlock and turn main battery disconnect switch to ON position..

m. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. (Dehydrate and evacuate compressor to 500 microns (29.90" Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.

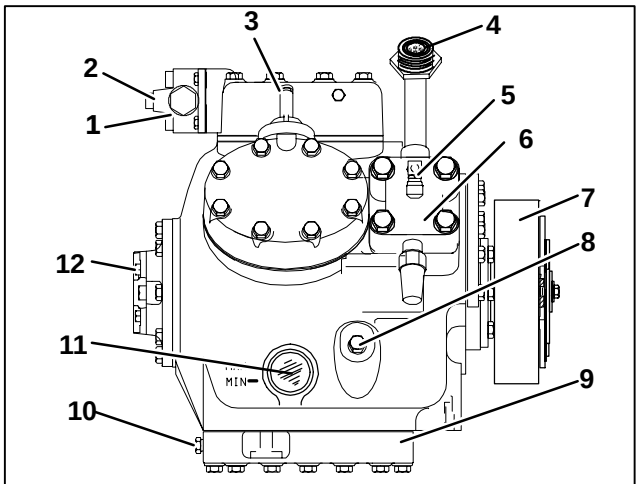
n. Fully backseat (open counterclockwise) both suction and discharge service valves.

o. Remove vacuum pump lines and install manifold gauges.

p. Start unit and check refrigerant level. (Refer to paragraph 4.7.1.)

q. Check compressor oil level. (Refer to paragraph 4.12.2.) Add or remove oil if necessary.

r. Check compressor unloader operation.



1. Discharge Service Valve
2. Service Port
3. Electric Unloader Valve
4. O'Ring
5. Suction Service Valve Service Port
6. Suction Service Valve
7. Clutch
8. Oil Fill Plug
9. Bottom Plate
10. Oil Drain Plug
11. Oil Level Sight Glass
12. Oil Pump

Figure 4-10. O5G Compressor

4.12.2 Compressor Oil Level

NOTE

The compressor should be fully loaded (six cylinder operation); the unit should be fully charged and the compressor crankcase should be warm to the touch.

a. Start the unit and allow the system to stabilize.

b. Check the oil sight glass on the compressor to ensure that no foaming of oil is present after 20 minutes of operation. If oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before proceeding.

c. Check the level of oil in oil level sight glass immediately after shutting down the compressor. The lowest level visible should be at the bottom of the sightglass and the highest level should be at the middle of the sight glass. (See Figure 4-10.)

4.12.3 Adding Oil with Compressor in System

The only recomended proceedure for adding POE oil to a compressor is to pump it in from a sealed container.

NOTE

Special care must be taken when working with POE oil that is used with HFC refrigerants such as R-134a, as POE oil is very hygroscopic. (POE oil will easily absorb water.) Do not leave POE oil containers open to the atmosphere.

a. One compressor oil pump that may be purchased is a Robinair part no. 14388. This oil pump adapts to one U.S. gallon *(3.785 liters)* metal refrigeration oil container and pumps 2-1/2 ounces *(72.5 milliliters)* per stroke when connected to the suction service valve port. Also, there is no need to remove pump from can after each use.

b. When the compressor is in operation, the pump check valve prevents the loss of refrigerant while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil, as necessary.

c. Backseat suction service valve and connect oil charging hose to port. Crack open the service valve and remove air from the oil hose at the oil pump. Add oil as necessary.

4.12.4 Adding Oil to Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If the replacement compressor is shipped without oil, add oil through the oil fill plug. (See Figure 4-10.)

4.12.5 Removing Oil from the Compressor:

a. If the lowest oil level observed in paragraph 4.12.2, step c., is above middle of the sight glass on compressor crankcase, oil must be removed from the compressor by performing the following procedure. If lowest oil level visible is below bottom of the sightglass, oil must be added to the compressor by following the procedure in paragraph 4.12.3.

b. Close (frontseat) suction service valve and pump unit down to 3 to 5 psig *(21 to 34 kPa).* Reclaim remaining refrigerant.

NOTE

If oil drain plug is not accessible, it will be necessary to extract oil through the oil fill plug with a siphon tube.

WARNING

EXTREME CARE MUST BE TAKEN TO ENSURE THAT ALL THE REFRIGERANT HAS BEEN REMOVED FROM THE COMPRESSOR CRANKCASE OR THE RESULTANT PRESSURE WILL FORCIBLY DISCHARGE COMPRESSOR OIL.

c. Remove the oil drain plug on the bottom plate of the compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.

d. Repeat step a. to ensure proper oil level.

Table 4-1. Temperature Sensor (AT, TSC, TSD and TSR) Resistance

Temperature		Resistance In Ohms
_F	_C	
-20	-28.9	165,300
-10	-23.3	117,800
0	-17.8	85,500
10	-12.2	62,400
20	- 6.7	46,300
30	- 1.1	34,500
32	0	32,700
40	4.4	26,200
50	10.0	19,900
60	15.6	15,300
70	21.1	11,900
77	25	10,000
80	26.7	9,300
90	32.2	7,300
100	37.8	5,800
110	43.3	4,700
120	48.9	3,800

4.13 TEMPERATURE SENSOR CHECKOUT

a. An accurate ohmmeter must be used to check resistance values shown in Table 4-1.

b. Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within two percent of the chart value would be considered good. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in the Table 4-1.

c. At least one sensor lead must be disconnected from the controller before any reading can be taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor are an ice bath at 32_F *(0_C)* and/or a calibrated digital temperature meter.

d. If the driver display indicates that temperature at sensor is -40_F *(-40_C)*, sensor could be open. If driver display indicates that temperature at sensor is 127_F *(52.8_C)*, sensor could be shorted.

Table 4-2. Suction and Discharge Pressure Transducer (SPT and DPT) Voltage					
Psig	**Voltage**	**Psig**	**Voltage**	**Psig**	**Voltage**
20”	0.369	105	1.495	220	2.622
10”	0.417	110	1.544	225	2.671
0	0.466	115	1.593	230	2.720
5	0.515	120	1.642	235	2.769
10	0.564	125	1.691	240	2.818
15	0.614	130	1.740	245	2.867
20	0.663	135	1.789	250	2.916
25	0.712	140	1.838	255	2.965
30	0.761	145	1.887	260	3.014
35	0.810	150	1.936	265	3.063
40	0.858	155	1.985	270	3.112
45	0.907	160	2.034	275	3.161
50	0.956	165	2.083	280	3.210
55	1.007	170	2.132	285	3.259
60	1.054	175	2.181	290	3.308
65	1.103	180	2.230	295	3.357
70	1.152	185	2.279	300	3.406
75	1.204	190	2.328	305	3.455
80	1.250	195	2.377	310	3.504
85	1.299	200	2.426	315	3.553
90	1.348	205	2.475	320	3.602
95	1.397	210	2.524	325	3.651
100	1.446	215	2.573	330	3.700

4.14 SUCTION AND DISCHARGE PRESSURE TRANSDUCER CHECKOUT

NOTE

System must be operating to check transducers.

a. With the system running, use the driver display or manifold gauges to check suction and/or discharge pressure(s).

b. Use a digital volt-ohmmeter to measure voltage across the transducer and compare to values in Table 4-2. A reading within two percent of the values in the table would be considered good.

4.15 REPLACING SENSORS AND TRANSDUCERS

a. Turn main battery disconnect switch to OFF position.

b. Tag and disconnect wiring from defective sensor or transducer.

c. Remove and replace defective sensor or transducer.

d. Connect wiring to replacement sensor or transducer.

e. Checkout replacement sensor or transducer. (Refer to paragraph 4.13 or 4.14 as applicable.)

4.16 SERVICING PASSENGER EVAPORATOR AIR FILTER

a. Turn main battery disconnect switch to OFF position.

b. Remove evaporator access door.

c. Rotate two clips securing the top of the filter to the face of the evaporator.

d. Remove the filter taking care not to catch the filter on wire harness or refrigerant tubing.

e.Re-install by performing the above procedure in reverse.

4.17 SERVICING PASSENGER EVAPORATOR MOTOR

a. Turn main battery disconnect switch to OFF position.

b. Remove evaporator access door.

c. Disconnect electrical connections.

d. Remove the support bracket connecting the blower housing to the motor bracket assembly.

e. Remove the mounting bolts securing the motor bracket/motor assembly to the frame of the evaporator..

f. Remove the four screws securing the blower housing venturi ring to the blower housing.

g. Remove the motor bracket, the motor and the blower wheel as an assembly, sliding out of blower housing, and removing from the evaporator.

h. Repair or replace any defective component(s), as required.

4.18 SERVICING PASSENGER EVAPORATOR MOTOR BRUSHES

a. Turn main battery disconnect switch to OFF position.

b. Remove evaporator access door.

c. Remove wires from terminals A1 and A2.

d. Remove cover exposing brushes.

e. Inspect brushes and replace as necessary.

4.19 SERVICING THE PASSENGER EVAPORATOR/HEATER COIL

NOTE

The evaporator/heater coil module must be removed from the coach for service.

a. Pump down low side of the HVAC system. (Refer to paragraph 4.4.1.)

b. Remove remaining refrigerant. (Refer to paragraph 4.4.)

c. Turn main battery disconnect switch to OFF position.

d. Disconnect refrigerant lines at the refrigerant liquid inlet connection, the suction outlet connection, and the liquid line driver's connection.(See Figure 1-5)

e. Loosen hex nut securing suction tube to suction tube support bracket.

f. Plug up the copper tube outlets.

g. Drain engine coolant from the heater coil.

h. Remove the heater coil hoses from the heater coil inlet and outlet connections.

i. Disconnect the suction temperature sensor.

j. Remove the air filter.

k. Remove the two coil mount brackets. (See Figure 1-5)

l. Remove the 10 screws securing the coil to the housing and removable flange.

m. Remove the removable flange.

n. Remove evaporator/heater coil.

o. Repair or replace defective component(s), as required.

p. Re-install by performing the above procedure in reverse.

NOTE

Torque values for ORS fittings(See Table 4-4)

4.20 SERVICING THE CONDENSER COIL

NOTE

The condenser assembly module must be removed from the coach to service the condenser coil.

a. Remove and reclaim the entire refrigerant charge. (Refer to paragraph 4.4.2.)

b. Turn main battery disconnect switch to OFF position.

c. Disconnect all electrical leads to the module.

d. Disconnect refrigerant lines to the module.

e. Remove the six mounting bolts located underneath the base of the unit.

f. Remove the two condenser support braces securing the top of the condenser to the coach. (See Figure 1-2)

g. Remove the condenser assembly module from the coach.

h. Remove both front upper and lower covers.

i. Remove the condenser motors and support rails.

j. Unbraze the discharge line assembly, the parcel liquid line, the subcooler inlet and the subcooler outlet tubes from the coil assembly.

k. Remove the top, left, and right panels.

l. Remove condenser coil assembly.

m. Repair or replace the condenser coil.

n. Re-install by performing the above procedure in reverse.

NOTE

Torque values for ORS fittings(See Table 4-4)

4.21 SERVICING THE CONDENSER MOTOR

a. Turn main battery disconnect switch to OFF position.

b. Remove front condenser shroud.

c. Remove fan blade, secure the shaft key to the fan hub slot.

d. Disconnect the wires to the motor.

e. Remove the four motor base mounting screws.

f. Remove the motor and place on workbench.

g. Repair or replace defective component(s), as required.

h. Re-install by performing the above procedure in reverse.

4.22 SERVICING CONDENSER MOTOR BRUSHES

a. Turn main battery disconnect switch to OFF position.

b. Remove front condenser shroud.

c. Remove fan blade, secure the shaft key to the fan hub slot.

d. Inspect brushes and replace as necessary.

e. Re-install by performing the above procedure in reverse.

4.23 SERVICING THE DRIVER EVAPORATOR

4.23.1 Access(Bottom) Cover Removal

a. Turn main battery disconnect switch to OFF position.

b. Open access door located in front of left front wheel of coach.

c. Using a flat screwdriver, unfasten four 1/4 turn fasteners from access cover on driver evaporator assembly.

d. Remove the two condensate drain hoses from access cover.

e. Remove the nine screws securing the access cover to the evaporator housing.(Four screws each side and one on the back side

f. Remove the access cover.

4.23.2 Blower Removal

a. Remove bottom access cover (step 4.23.1).

b. Disconnect packard plug from the blower and speed controller.

c. Undo motor mount screws (two per motor).

d. Drop the blower down and remove.

NOTE

The lower motor will need to be removed if the upper motor needs to be serviced.

e. Re-install by performing the above procedure in reverse, being careful not to overtighten the blower mounting screws.

4.23.3 Coolant/Solenoid Valve Coil Replacement

a. Remove bottom access cover (step 4.23.1).

b. Remove both blower motor assemblies (step 4.23.2) to access the coolant valve. The solenoid valve will require that only the lower blower be removed for access.

c. Removal of either coil can now be accomplished by unplugging the electrical lead, and removing the retaining nut/screw.

d. Re-install by performing the above procedure in reverse.

NOTE

Servicing of the valve bodies will require removal of the Evapoator/heater coil assembly (step 4.23.5).

4.23.4 Air Filter Removal

a. Open the filter access door by loosening the four quarter turn fasteners.

b. Slide filter up and out through the filter access door..

c. Clean/replace filter and re-install.

4.23.5 Removal of Evaporator/Heater Core Assembly

a. Pump down the refrigerant system. (Refer to paragraph 4.4.1.)

b. Disconnect liquid line and suction line fittings..

c. Turn main battery disconnect switch to OFF position.

d. Drain engine coolant from the heater coil.

e. Remove the heater coil hoses from the heater coil inlet and outlet connections.

f. Remove the screws securing the air duct support brackets to the evaporator housing, and remove the support brackets.

g. Disconnect control circuit, battery, and ground electrical leads.

h. Disconnect condensate drain lines.

i. Remove screws securing driver evaporator to the coach, remove assembly from coach, and place on a secure work surface.

j. Remove the top panel of the evaporator housing.

k. Remove the nuts securing the liquid and suction lines to the back of the evaporator housing.

l. Remove the screws securing the back of the evaporator housing, and remove the panel.

m. Unclip the liquid line solenoid valve and heat valve coil from the harness.

n. Remove the screws securing the evaporator/heater core to the housing.

o. Lift evaporator/heater coil up and place on a work surface.

p. Re-install by performing the above procedure in reverse.

NOTE

Torque values for ORS fittings(See Table 4-4)

4.23.6 RAM Air Actuator Removal

a. Turn main battery disconnect switch to OFF position.

b. Disconnect the packard plug.

c. Remove the no. 10 screw from the end of the spring on the RAM air actuator.

d. Remove the actuator from its retaining clip.

e. Re-install by performing the above procedure in reverse.

4.24 LOGIC BOARD CONFIGURATION

Control configuration is preset by the manufacturer and resetting of the parameters is not advised. If a replacement Logic Board is installed, it is necessary to match the configuration jumpers (see Figure 1-10) to the original board. Table 4-3 provides a list of jumper functions. Carrier is not responsible for failures or damage resulting from unauthorized changes.

Table 4-3. Logic Board Configuration

Configuration	Description
A.	High Reheat – When this configuration is removed, the unit will default to high speed in reheat mode and in the low speed cool band. If not removed, heat/reheat will default to low speed.
B.	High Vent – When this configuration is removed, the unit will default to high speed in vent mode. If not removed vent mode will default to low speed.
C.	Dry Heat– When this configuration is removed, the unit will run on 100% reheat instead of heat.
D.	Reheat/Cycle – When the reheat cycle configuration is removed, the unit is in reheat mode. The default configuration is cycle clutch mode.
E.	Transducers – When the transducer configuration is removed, transducers will assume to be present.
F.	Refrigerant R-22/R-134a – When the refrigerant configuration is removed, the refrigerant is set for R-22. The default refrigerant is R-134a.
G.	Unit Type – Rearmount unit enabled with “G” removed and “H” installed.
H.	Unit Type – With “H” removed and “G” installed, roof top unit will be enabled.
I.	Factory – Reserved for the manufacturer.
J.	Invert H_2O – When this configuration is removed, the logic for the water temperature switch will be inverted.
K.	Voltage – When this configuration is removed, the voltage selection will be changed from 12 to 24 vdc.
L.	Factory – Reserved for the manufacturer.
M.	Psig/Bars – When this configuration is removed, the display will indicate pressures in *bars*. When not removed, the display will indicate pressures in *psig*.
N.	°C/°F – When this configuration is removed, the display will show temperatures in °F. When not removed the display will show temperatures in °C.
O.	Loaded Start – When this configuration is removed, the unit will start fully loaded instead of staging the unloaders after the clutch is energized
P.	PI Reheat – When this configuration is removed, reheat mode will use the PI algorithm to vary the duty cycle of the heat valve. If it is not removed, the heat will be constant.

Table 4-4. Torque Ratings - ORS Connections

ORS Size	Thread	Torque
-4	9/16"-18	85-110 IN/LBS
-6	11/16"-16	125-160 IN/LBS
-8	13/16"-16	165-220 IN/LBS
-10	1"-14	325-400 IN/LBS
-12	1-3/16"-12	45-55 FT./LBS
-16	1-7/16"-12	65-80 FT./LBS
-20	1-11/16"-12	95-105 FT./LBS

Table 4-5. R-134a Temperature - Pressure Chart

Temperature		Vacuum		
°F	°C	"/hg	Kg/cm@	Bar
-40	-40	14.6	37.08	0.49
.35	.37	12.3	31.25	0.42
-30	-34	9.7	24.64	0.33
-25	-32	6.7	17.00	0.23
-20	-29	3.5	8.89	0.12
-18	-28	2.1	5.33	0.07
-16	-27	0.6	1.52	0.02

Temperature		Pressure		
°F	°C	Psig	Kg/cm@	Bar
-14	-26	0.4	0.03	0.03
-12	-24	1.2	0.08	0.08
-10	-23	2.0	0.14	0.14
-8	-22	2.9	0.20	0.20
-6	-21	3.7	0.26	0.26
-4	-20	4.6	0.32	0.32
-2	-19	5.6	0.39	0.39
0	-18	6.5	0.46	0.45
2	-17	7.6	0.53	0.52
4	-16	8.6	0.60	0.59
6	-14	9.7	0.68	0.67
8	-13	10.8	0.76	0.74
10	-12	12.0	0.84	0.83
12	-11	13.2	0.93	0.91
14	-10	14.5	1.02	1.00
16	-9	15.8	1.11	1.09
18	-8	17.1	1.20	1.18
20	-7	18.5	1.30	1.28
22	-6	19.9	1.40	1.37
24	-4	21.4	1.50	1.48
26	-3	22.9	1.61	1.58

Temperature		Pressure		
°F	°C	Psig	Kg/cm@	Bar
28	-2	24.5	1.72	1.69
30	-1	26.1	1.84	1.80
32	0	27.8	1.95	1.92
34	1	29.6	2.08	2.04
36	2	31.3	2.20	2.16
38	3	33.2	2.33	2.29
40	4	35.1	2.47	2.42
45	7	40.1	2.82	2.76
50	10	45.5	3.20	3.14
55	13	51.2	3.60	3.53
60	16	57.4	4.04	3.96
65	18	64.1	4.51	4.42
70	21	71.1	5.00	4.90
75	24	78.7	5.53	5.43
80	27	86.7	6.10	5.98
85	29	95.3	6.70	6.57
90	32	104.3	7.33	7.19
95	35	114.0	8.01	7.86
100	38	124.2	8.73	8.56
105	41	135.0	9.49	9.31
110	43	146.4	10.29	10.09
115	46	158.4	11.14	10.92
120	49	171.2	12.04	11.80
125	52	184.6	12.98	12.73
130	54	198.7	13.97	13.70
135	57	213.6	15.02	14.73
140	60	229.2	16.11	15.80
145	63	245.6	17.27	16.93
150	66	262.9	18.48	18.13
155	68	281.1	19.76	19.37

SECTION 5
ELECTRICAL SCHEMATIC DIAGRAMS

5.1 INTRODUCTION

This section contains Electrical Schematic Diagrams covering the Models listed in Table 1-1. Contact your Carrier Transicold service representative or call the technical hot line at 800-450-2211 for a copy of the schematic for your specific model.

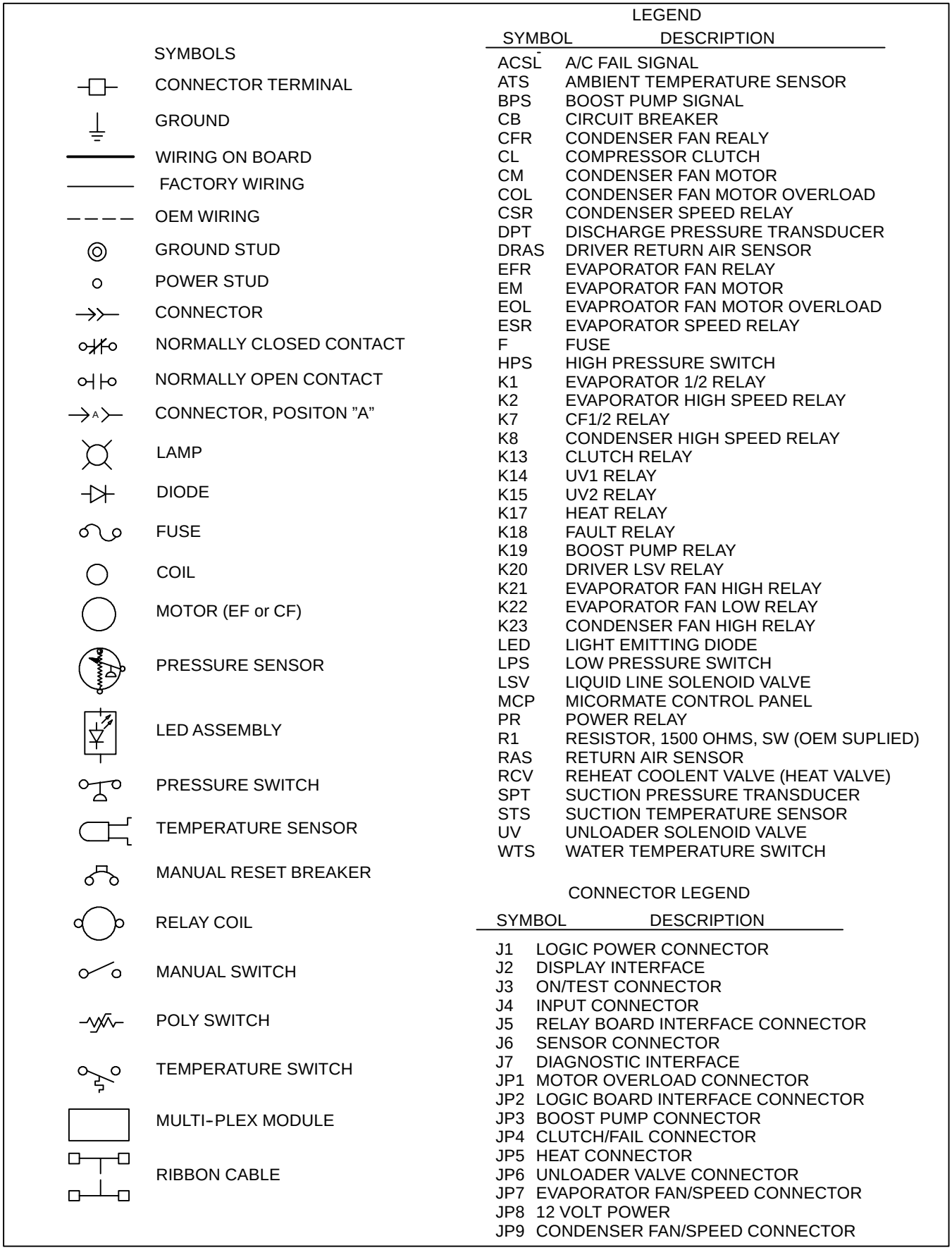
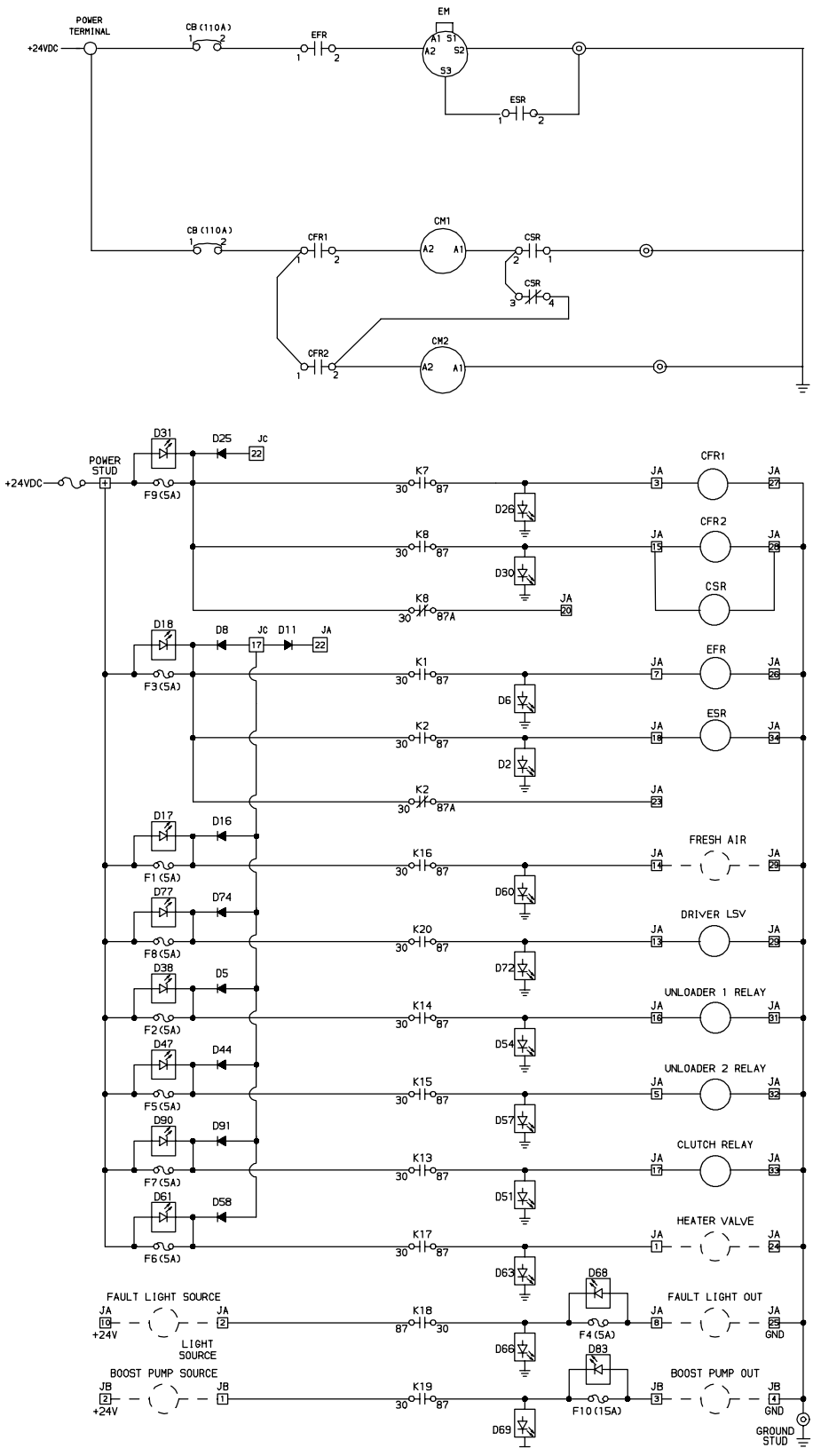


Figure 5-1. Electrical Schematic Diagram Legend and Symbols



See Figure 5-1 for Legend and Symbols.

Figure 5-2. Wiring Schematic - Power Circuit

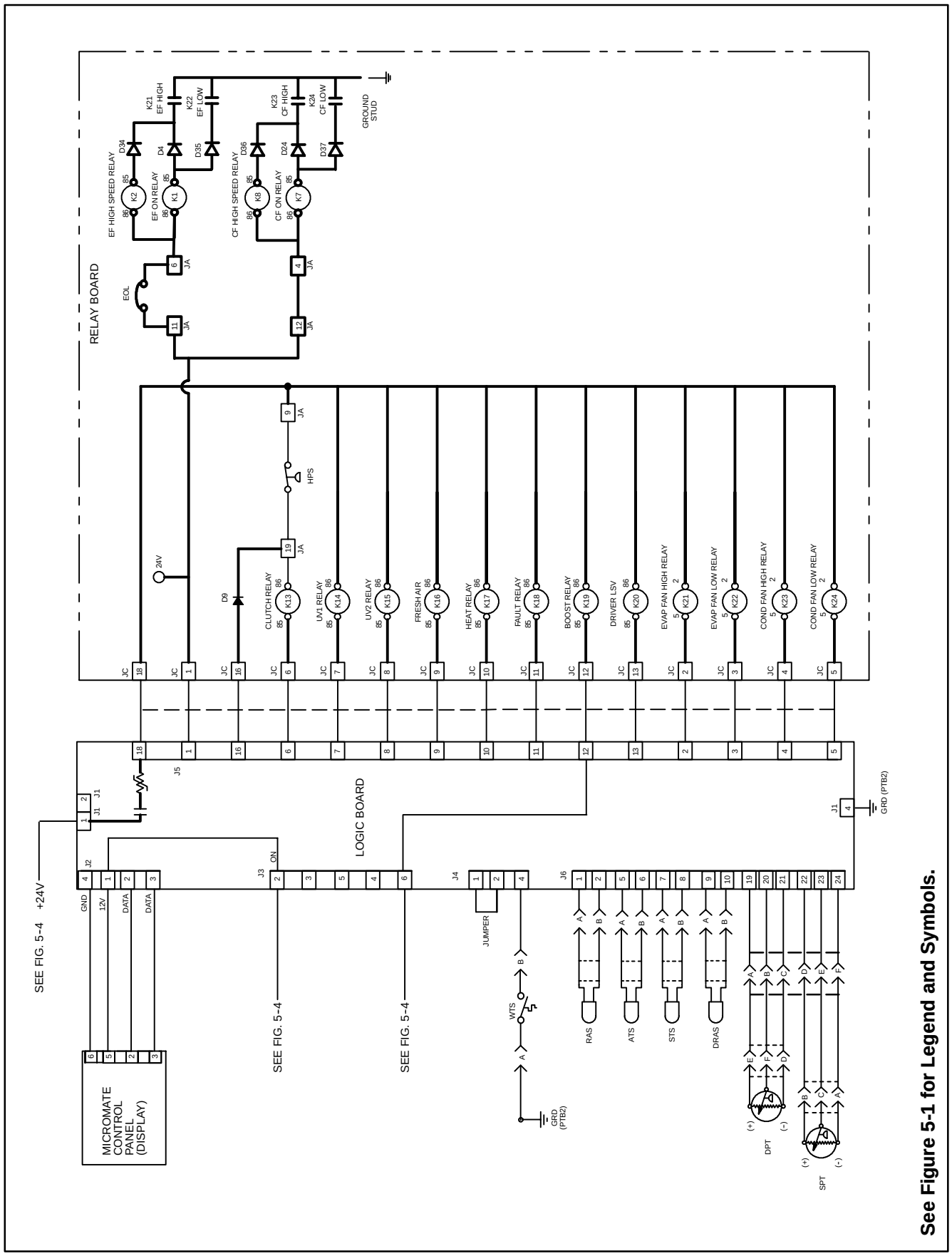
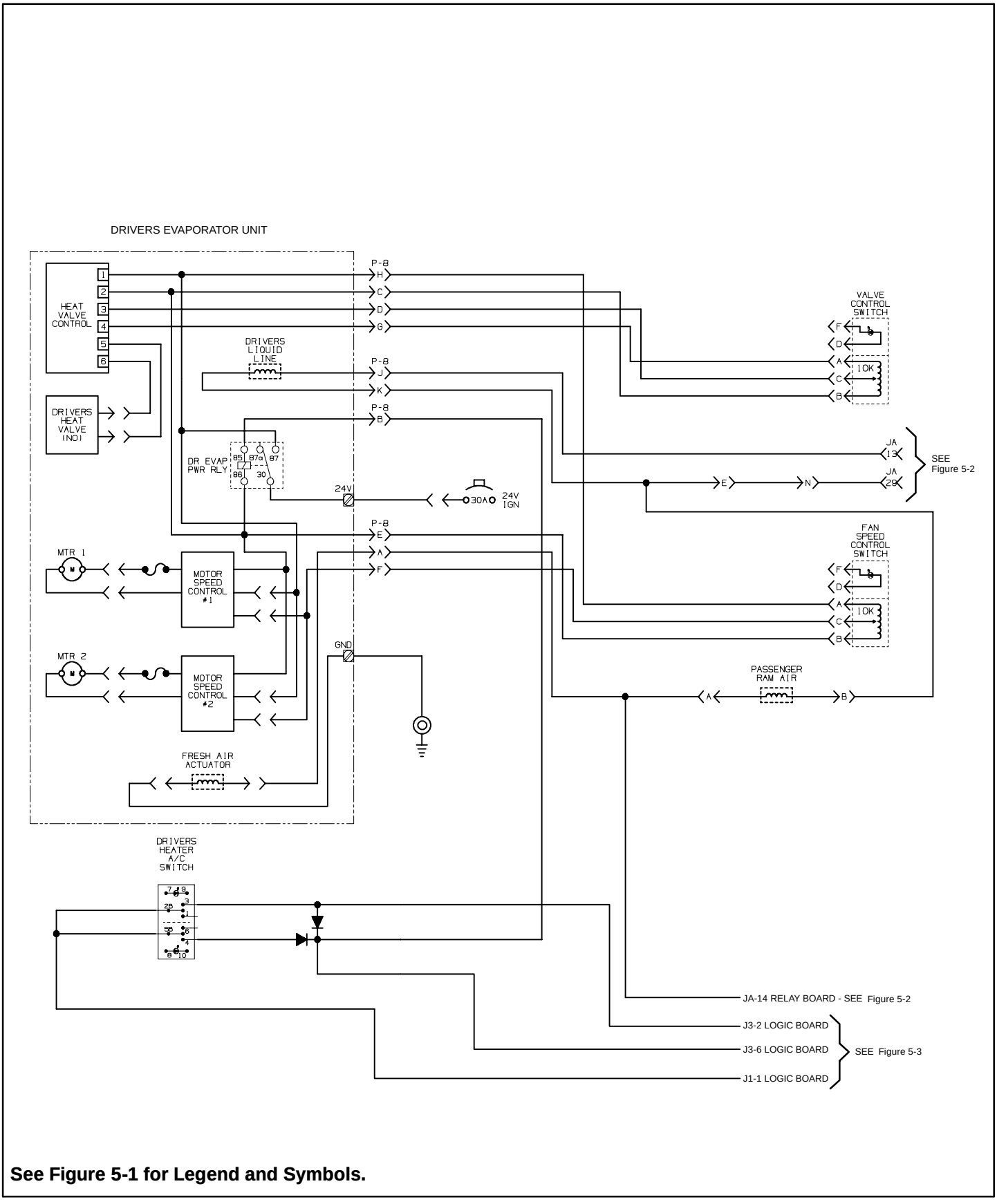


Figure 5-3. Wiring Schematic - Logic/Relay Board



See Figure 5-1 for Legend and Symbols.

Figure 5-4. Wiring Schematic - Driver Evaporator

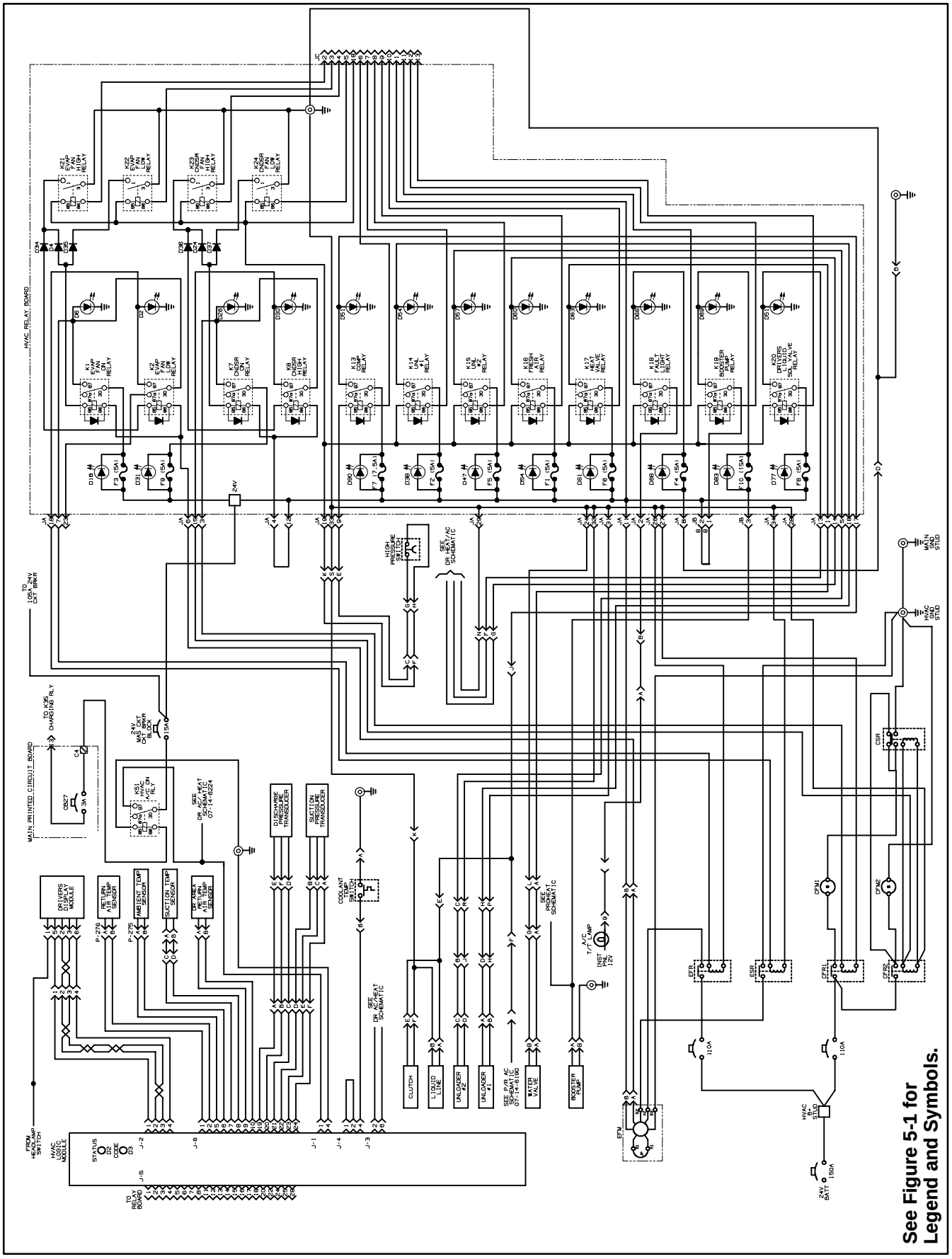


Figure 5-5. Wiring Schematic Diagram

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